

# **Community Health Baseline Report**

(Data update from the 2019 Community Health Baseline Report; no field-based data collection or verification updates included)

## **Papua LNG Project – Downstream**

**April 2023**

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# Contents

|           |                                                                                          |           |
|-----------|------------------------------------------------------------------------------------------|-----------|
| <b>1.</b> | <b>Introduction .....</b>                                                                | <b>1</b>  |
| 1.1       | Project overview .....                                                                   | 1         |
| 1.2       | Objectives.....                                                                          | 5         |
| <b>2.</b> | <b>Regulatory framework and standards.....</b>                                           | <b>5</b>  |
| 2.1       | National legislation .....                                                               | 5         |
| 2.2       | National Health Development Objectives .....                                             | 6         |
| 2.2.1     | Papua New Guinea Vision 2050 .....                                                       | 6         |
| 2.2.2     | Papua New Guinea Development Strategic Plan 2010–2030 .....                              | 7         |
| 2.2.3     | National Health Plan 2011–2020 .....                                                     | 8         |
| 2.2.4     | Medium Term Development Plan 2018–2022 .....                                             | 9         |
| 2.2.5     | National Health Service Standards for Papua New Guinea 2011–2020 .....                   | 10        |
| 2.2.6     | National Strategy for Responsible Sustainable Development for Papua New Guinea.....      | 11        |
| 2.2.7     | 2014 National Human Development Report .....                                             | 11        |
| 2.2.8     | Health Financing aspects.....                                                            | 12        |
| 2.2.9     | Human development indices and indicators: 2021 Statistical Update: Papua New Guinea..... | 13        |
| 2.3       | Industry standards and international good practice .....                                 | 13        |
| 2.3.1     | International Finance Corporation.....                                                   | 13        |
| 2.3.2     | International Petroleum Industry Environmental Conservation Association .....            | 14        |
| 2.3.3     | World Health Organization .....                                                          | 14        |
| <b>3.</b> | <b>Study area.....</b>                                                                   | <b>15</b> |
| 3.1       | Study area .....                                                                         | 15        |
| <b>4.</b> | <b>Existing information .....</b>                                                        | <b>17</b> |
| <b>5.</b> | <b>Methods .....</b>                                                                     | <b>18</b> |
| 5.1       | General approach .....                                                                   | 18        |
| 5.1.1     | Identify data requirements for health .....                                              | 18        |
| 5.1.2     | Develop sampling framework.....                                                          | 20        |
| 5.1.3     | Health study team .....                                                                  | 20        |
| 5.1.4     | Social and health surveys .....                                                          | 21        |
| 5.2       | Limitations .....                                                                        | 21        |
| <b>6.</b> | <b>Baseline characterisation.....</b>                                                    | <b>21</b> |
| 6.1       | Methodology for organising baseline health data .....                                    | 21        |
| 6.2       | Demographic data summary .....                                                           | 23        |
| 6.2.1     | Overall population data .....                                                            | 23        |
| 6.2.2     | Population structure .....                                                               | 25        |
| 6.3       | LNG Plant villages burden of disease: Morbidity and mortality .....                      | 31        |
| 6.3.1     | Morbidity data.....                                                                      | 31        |
| 6.3.2     | Clinic-based morbidity data.....                                                         | 31        |
| 6.3.3     | Household survey morbidity data.....                                                     | 34        |
| 6.3.4     | Mortality data.....                                                                      | 49        |
| 6.4       | Stakeholder/key informant interviews .....                                               | 52        |
| 6.4.1     | Stakeholder engagement.....                                                              | 52        |
| 6.4.2     | Stakeholder engagement key findings.....                                                 | 56        |
| 6.5       | Environmental Health Area 1—health systems .....                                         | 57        |
| 6.5.1     | Overview of the provincial health care system.....                                       | 57        |

|           |                                                                                              |            |
|-----------|----------------------------------------------------------------------------------------------|------------|
| 6.5.2     | Sources of information .....                                                                 | 59         |
| 6.6       | Environmental Health Area 2—communicable respiratory diseases .....                          | 76         |
| 6.6.1     | Overview .....                                                                               | 77         |
| 6.6.2     | Sources of information .....                                                                 | 83         |
| 6.7       | Environmental Health Area 3—vector-borne diseases .....                                      | 87         |
| 6.7.1     | Overview .....                                                                               | 87         |
| 6.8       | Environmental Health Area 4—sexually transmitted infections .....                            | 91         |
| 6.8.1     | Overview .....                                                                               | 91         |
| 6.8.2     | Sources of information .....                                                                 | 91         |
| 6.9       | Environmental Health Area 5—water- and sanitation-related diseases .....                     | 95         |
| 6.9.1     | Overview .....                                                                               | 95         |
| 6.9.2     | Sources of information .....                                                                 | 95         |
| 6.10      | Environmental Health Area 6—food- and nutrition-related issues including food security ..... | 100        |
| 6.10.1    | Overview .....                                                                               | 100        |
| 6.10.2    | Sources of information .....                                                                 | 101        |
| 6.11      | Environmental Health Area 7—non-communicable diseases .....                                  | 102        |
| 6.11.1    | Overview .....                                                                               | 102        |
| 6.11.2    | Sources of information .....                                                                 | 102        |
| 6.12      | Environmental Health Area 8—accidents and injuries .....                                     | 104        |
| 6.12.1    | Overview .....                                                                               | 104        |
| 6.12.2    | Sources of information .....                                                                 | 104        |
| 6.13      | Environmental Health Area 9—exposure to potentially hazardous materials .....                | 105        |
| 6.13.1    | Overview .....                                                                               | 105        |
| 6.13.2    | Sources of information .....                                                                 | 106        |
| 6.14      | Environmental Health Area 10—social determinants of health .....                             | 107        |
| 6.14.1    | Overview .....                                                                               | 107        |
| 6.14.2    | Sources of information .....                                                                 | 107        |
| 6.15      | Environmental Health Area 11—veterinary medicine and zoonotic diseases .....                 | 109        |
| 6.15.1    | Overview .....                                                                               | 109        |
| 6.15.2    | Sources of information .....                                                                 | 109        |
| 6.16      | Environmental Health Area 12—cultural health practices .....                                 | 110        |
| 6.16.1    | Overview .....                                                                               | 110        |
| 6.16.2    | Sources of information .....                                                                 | 110        |
| <b>7.</b> | <b>Conclusions .....</b>                                                                     | <b>112</b> |
| <b>8.</b> | <b>Bibliography .....</b>                                                                    | <b>114</b> |

## Figures

|             |                                                                                                     |    |
|-------------|-----------------------------------------------------------------------------------------------------|----|
| Figure 1-1. | Papua LNG Project – Downstream Project location .....                                               | 4  |
| Figure 2-1. | National Health Plan 2011-2020, "Health Vision 2050" .....                                          | 9  |
| Figure 3-1. | LNG Plant study area .....                                                                          | 16 |
| Figure 6-1. | Combined 2017 Papua New Guinea Institute of Medical Research Hiri villages population pyramid ..... | 26 |
| Figure 6-2. | Combined LNG Plant villages population pyramids .....                                               | 27 |
| Figure 6-3. | Papua New Guinea national population pyramid (2016-2018) .....                                      | 28 |
| Figure 6-4. | Hiri District LNG Plant villages population pyramids 2015 and 2018 .....                            | 29 |
| Figure 6-5. | LNG Plant villages morbidity patterns 2009–2016 .....                                               | 32 |
| Figure 6-6. | Probable cause of adult death—Hiri (2015) .....                                                     | 51 |
| Figure 6-7. | 2021 Pentavalent vaccination coverage Papa and Porebada sub health centres (three doses [%]) .....  | 78 |
| Figure 6-8. | Measles vaccination coverage Papa and Porebada sub health centres 2019–2021 .....                   | 79 |
| Figure 6-9. | Outpatient cases (counts) 2014-2021 respiratory diseases .....                                      | 80 |

|                                                                                                          |    |
|----------------------------------------------------------------------------------------------------------|----|
| Figure 6-10. Epidemiological curve of total COVID-19 cases in Papua New Guinea (11 September 2022) ..... | 81 |
| Figure 6-11. Cumulative COVID-19 infections and deaths by age and sex September 2022 .....               | 81 |
| Figure 6-12. Longitudinal malaria percent positive test data .....                                       | 90 |
| Figure 6.13. Causative agents of paediatric acute watery diarrhoea at Goroka General Hospital.....       | 96 |
| Figure 6.14. 2019–2021 Diarrhoeal disease incidence data Papa and Porebada sub health centres            | 98 |

## Tables

|                                                                                                                                                                                                |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1-1. Project components at the LNG Plant .....                                                                                                                                           | 2  |
| Table 2-1. Medium Term Development Plan health key performance indicators 2015–2030.....                                                                                                       | 10 |
| Table 2-2. Papua New Guinea HDI Trends 1990-2017 .....                                                                                                                                         | 13 |
| Table 5-1. Project area of influence health facilities 2019 field studies .....                                                                                                                | 20 |
| Table 6-1. Central Province population growth rates.....                                                                                                                                       | 23 |
| Table 6-2. Papua New Guinea national census population/household data 2000 and 2011 LNG Plant villages .....                                                                                   | 23 |
| Table 6-3. Papua New Guinea Institute of Medical Research LNG Village census data 2011–2018..                                                                                                  | 24 |
| Table 6-4. Population estimates of the LNG Plant villages.....                                                                                                                                 | 25 |
| Table 6-5. LNG Plant villages census.....                                                                                                                                                      | 25 |
| Table 6-6. Population age, sex ratios, and dependency ratios comparison .....                                                                                                                  | 30 |
| Table 6-7. LNG Plant Village health facility morbidity data 2016.....                                                                                                                          | 32 |
| Table 6-8. LNG Plant Village health facility morbidity data 2017.....                                                                                                                          | 33 |
| Table 6-9. Use of health services—reason services were sought within the 2 weeks preceding the survey (2019) .....                                                                             | 35 |
| Table 6-10. Use of health services—location of services (2019).....                                                                                                                            | 37 |
| Table 6-11. Use of health services (2019) .....                                                                                                                                                | 39 |
| Table 6-12. Family health questions — cough (2019) .....                                                                                                                                       | 40 |
| Table 6-13. Family health questions—cough, location of services (2019) .....                                                                                                                   | 41 |
| Table 6-14. Family health questions—fever (2019).....                                                                                                                                          | 43 |
| Table 6-15. Family health questions—fever, location of services (2019) .....                                                                                                                   | 44 |
| Table 6-16. Family health questions—diarrhoea (2019).....                                                                                                                                      | 46 |
| Table 6-17. Family health questions—diarrhoea, location of services (2019).....                                                                                                                | 47 |
| Table 6-18. Fever, cough, and diarrhoea comparison—LNG Plant villages (2019) versus 2018 demographic health survey .....                                                                       | 49 |
| Table 6-19. 2011 Estimated cause-specific mortality fraction (CSMF).....                                                                                                                       | 50 |
| Table 6-20. Papua New Guinea national early childhood mortality rates .....                                                                                                                    | 51 |
| Table 6-21. Child mortality rate estimation—Hiri 2015 and 2016 .....                                                                                                                           | 52 |
| Table 6-22. Key findings from stakeholder engagement .....                                                                                                                                     | 53 |
| Table 6-23. Key SPAR indicators 2021 for Central Province, Kairuku-Hiri District, Porebada Sub Health Centre, Papa Sub Health Centre, National Capital District, and National Papua New Guinea | 58 |
| Table 6-24. Project area of influence health facilities—staffing and supervision (2019) .....                                                                                                  | 60 |
| Table 6-25. Health facilities—physical infrastructure (2019) .....                                                                                                                             | 60 |
| Table 6-26. Health care access by village (2019).....                                                                                                                                          | 61 |
| Table 6-27. Use of health services (2019) .....                                                                                                                                                | 62 |
| Table 6-28. Children under 5 years of age—mother birth experience and location (2019).....                                                                                                     | 63 |
| Table 6-29. Children under 5 years of age—mother birth experience—birth and antenatal care (2019) .....                                                                                        | 65 |
| Table 6-30. Papua New Guinea COVID-19 vaccination accumulation coverage (20 November 2022) .....                                                                                               | 82 |
| Table 6-31. Tuberculosis incidence rates .....                                                                                                                                                 | 83 |
| Table 6-32. Papua New Guinea Institute of Medical Research LNG Plant Village tuberculosis study results (2014) .....                                                                           | 85 |
| Table 6-33. LNG Plant Village health facilities tuberculosis passive case detection data (2013–2021) .....                                                                                     | 86 |

|                                                                                                                                                              |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Table 6-34. Key Findings Papua New Guinea Institute of Medical Research malaria indicator survey Central Province versus National Capital District .....     | 88  |
| Table 6-35. Use of bed nets – quantity and treatment (2019) .....                                                                                            | 88  |
| Table 6-36. Use of bed nets – sleeping (2019).....                                                                                                           | 89  |
| Table 6-37. Use of bed nets – source (2019) .....                                                                                                            | 89  |
| Table 6-38. Summary of published data on antenatal HIV/sexually transmitted infection prevalence among pregnant women in Papua New Guinea <sup>1</sup> ..... | 92  |
| Table 6-39. 2021 SPAR HIV national sero-surveillance antenatal clinic data (2016-2020) .....                                                                 | 93  |
| Table 6-40. STIs reported at Papa and Porebada sub health centres .....                                                                                      | 94  |
| Table 6-41. 2021 Diarrhoeal disease data (eNHIS).....                                                                                                        | 97  |
| Table 6-42. What type of toilet do you have at your house? .....                                                                                             | 100 |
| Table 6-43. Nutritional key performance indicator data for Central Province, Kairuku-Hiri District, Porebada and Papa sub health centres.....                | 101 |
| Table 6-44. Injury presentation per 1,000 population data (2021).....                                                                                        | 105 |
| Table 6-45. Papa and Porebada sub health centres motor vehicle injury data 2019–2021 .....                                                                   | 105 |
| Table 6-46. Background noise levels in study area .....                                                                                                      | 106 |

## **Plates**

|                                                                          |    |
|--------------------------------------------------------------------------|----|
| Plate 1. Porebada Sub Health Centre in 2019.....                         | 68 |
| Plate 2. New clinic building, supplies in Porebada .....                 | 68 |
| Plate 3. New clinic building, equipment, and exam room .....             | 69 |
| Plate 4. Papa Sub Health Centre catchment area.....                      | 72 |
| Plate 5. Papa Sub Health Centre delivery and patient care areas .....    | 73 |
| Plate 6. Notice of medicine shortage at the Papa Sub Health Centre.....  | 74 |
| Plate 7. Latrine behind the Boera Aid Post - used by the community ..... | 99 |

## Acronyms and abbreviations

|                    |                                                                         |
|--------------------|-------------------------------------------------------------------------|
| <b>ACD</b>         | Active case detection                                                   |
| <b>AGX</b>         | Associated Gas Expansion (Project)                                      |
| <b>ALRI</b>        | Acute lower respiratory tract infection                                 |
| <b>AMS</b>         | Area Medical Store                                                      |
| <b>ANC</b>         | Antenatal clinic                                                        |
| <b>ARI</b>         | Acute respiratory infection                                             |
| <b>ART</b>         | Antiretroviral Therapy (or Treatment)                                   |
| <b>BCG</b>         | Bacille Calmette-Guerin                                                 |
| <b>CDC</b>         | Centers for Disease Control                                             |
| <b>CHES</b>        | Comprehensive Health and Epidemiological Surveillance System            |
| <b>CHW</b>         | Community health worker                                                 |
| <b>COD</b>         | Cause of Death                                                          |
| <b>COHN-S</b>      | Certified Occupational Health Nurse-Specialist                          |
| <b>CSMF</b>        | Cause specific mortality fraction                                       |
| <b>DABT</b>        | Diplomat of American Board of Toxicology                                |
| <b>DFAT</b>        | Australian Department of Foreign Affairs and Trade                      |
| <b>DHS</b>         | Demographic health survey                                               |
| <b>DNPM</b>        | Department of National Planning and Monitoring                          |
| <b>DOTS</b>        | Directly observed treatment, short course                               |
| <b>DR</b>          | Dependency ratio                                                        |
| <b>DTM&amp;H</b>   | Diploma in Tropical Medicine and Hygiene                                |
| <b>DV</b>          | Domestic and sexual violence                                            |
| <b>EHA</b>         | Environmental health areas                                              |
| <b>eNHIS</b>       | Electronic National Health Information System                           |
| <b>EIS</b>         | Environmental impact statement                                          |
| <b>FGD</b>         | Focus group discussion                                                  |
| <b>FSW</b>         | Female sex worker                                                       |
| <b>GBV</b>         | Gender-based violence                                                   |
| <b>Global Fund</b> | Global Fund to Fight AIDS, Tuberculosis and Malaria                     |
| <b>GNI</b>         | Gross national income                                                   |
| <b>IFC</b>         | International Finance Corporation                                       |
| <b>iHDSS</b>       | Integrated Health Demographic Surveillance System                       |
| <b>IPIECA</b>      | International Petroleum Industry Environmental Conservation Association |
| <b>ITN</b>         | Insecticide-treated net                                                 |
| <b>Hb</b>          | Haemoglobin                                                             |
| <b>HDI</b>         | Human Development Index                                                 |
| <b>HED</b>         | Heavy episodic drinking                                                 |
| <b>HEO</b>         | Health extension officer                                                |
| <b>HIA</b>         | Health impact assessment                                                |
| <b>HIS</b>         | Health information system                                               |
| <b>HMIS</b>        | Health management information system                                    |
| <b>HPV</b>         | Human papilloma virus                                                   |
| <b>HSV</b>         | Human simplex virus                                                     |
| <b>KII</b>         | Key informant interview                                                 |
| <b>KPI</b>         | Key performance indicators                                              |
| <b>LLG</b>         | Local level government                                                  |
| <b>LNG</b>         | Liquified natural gas                                                   |
| <b>MDR</b>         | Multi-drug resistant                                                    |
| <b>MIS</b>         | Malaria indicator survey                                                |
| <b>MPH</b>         | Masters in Public Health                                                |

## Papua LNG Project – Downstream | Community Health Baseline

|                |                                                                       |
|----------------|-----------------------------------------------------------------------|
| <b>MRA</b>     | Mineral Resources Authority                                           |
| <b>MSF</b>     | Médecins Sans Frontières                                              |
| <b>MSI</b>     | Marie Stopes International                                            |
| <b>MSM</b>     | Men who have sex with men                                             |
| <b>MSN</b>     | Masters of Science in Nursing                                         |
| <b>MTDP</b>    | Medium Term Development Plan                                          |
| <b>mtpa</b>    | Million tonnes per annum                                              |
| <b>NACS</b>    | National AIDS Council and its secretariat                             |
| <b>NCD</b>     | Non-communicable diseases                                             |
| <b>NDOH</b>    | National Department of Health                                         |
| <b>NGO</b>     | Non-government organization                                           |
| <b>NHIS</b>    | National Health Information System                                    |
| <b>NSO</b>     | National Statistics Office                                            |
| <b>NTP</b>     | National Tuberculosis Control Program                                 |
| <b>OSL</b>     | Oil Search Limited                                                    |
| <b>PHA</b>     | Provincial Health Authority                                           |
| <b>PiHP</b>    | Partnership in Health Program                                         |
| <b>PNG IMR</b> | Papua New Guinea Institute of Medical Research                        |
| <b>POM</b>     | Port Moresby                                                          |
| <b>PPP</b>     | Purchasing power parity                                               |
| <b>PS</b>      | Performance standard                                                  |
| <b>PSI</b>     | Population Services International                                     |
| <b>RAM</b>     | Rotarians Against Malaria                                             |
| <b>RDT</b>     | Rapid diagnostic test                                                 |
| <b>RTA</b>     | Road traffic accident                                                 |
| <b>SDH</b>     | Social determinants of health                                         |
| <b>SIA</b>     | Social impact assessment                                              |
| <b>SPAR</b>    | Sector Performance Annual Review                                      |
| <b>StaRS</b>   | Strategy for Responsible Sustainable Development for Papua New Guinea |
| <b>STI</b>     | Sexually transmitted infection                                        |
| <b>TG</b>      | Transgender                                                           |
| <b>UN</b>      | United Nations                                                        |
| <b>UNAIDS</b>  | Joint UN Program on HIV/AIDS                                          |
| <b>UNDP</b>    | United Nations Development Programme                                  |
| <b>USAID</b>   | U.S. Agency for International Development                             |
| <b>VA</b>      | Verbal autopsy                                                        |
| <b>VBA</b>     | Village birth attendants                                              |
| <b>VBD</b>     | Vector-borne diseases                                                 |
| <b>WASH</b>    | Water, Sanitation, and Hygiene                                        |
| <b>WATSAN</b>  | Water and sanitation                                                  |
| <b>WHO</b>     | World Health Organization                                             |
| <b>XDR</b>     | Extensively drug resistant                                            |
| <b>YWAM</b>    | Youth with a Mission                                                  |

# **1. Introduction**

This Community Health Baseline Report was developed for inclusion in the environmental impact statement (EIS) for the Papua LNG Project – Downstream (the Project). This report has been prepared following research and studies conducted in the Central Province in 2019 and updated in November 2022 using a combination of: (1) recently published scientific studies (2019–2022), (2) Papua New Guinea National Department of Health Electronic Health Information System (eNHIS) data for the LNG Plant village health facilities, and (3) COVID-19 data from the Papua New Guinea Joint Agency Taskforce National Control Centre for COVID-19.

## **1.1 Project overview**

ExxonMobil PNG Limited (EMPNG) is the operator of the PNG LNG Project, an integrated development that is commercialising the gas resources of Papua New Guinea. The Papua LNG Project is a gas development project for the Papua LNG Project Joint Venture participants, which are:

- TotalEnergies EP PNG Limited (TotalEnergies, an affiliate of TotalEnergies SA).
- ExxonMobil PNG Antelope Limited (EMPNGA) and ExxonMobil PNG Elk Limited.
- Pac LNG Assets Limited, Pac LNG International Limited, Pac LNG Investments Limited, Pac LNG Overseas Limited and Pac LNG Holdings Limited (affiliates of Santos Limited).
- JX Nippon Oil and Gas Exploration Pty Ltd.

ExxonMobil PNG Antelope Limited is the Project proponent and the ExxonMobil affiliate responsible for the construction of the Project. Niugini LNG Operating Company Limited (NLOC) is the ExxonMobil affiliate responsible for the Project once it has been constructed and commissioned. The Papua LNG Project will involve producing and processing the gas and condensate from the Elk and Antelope gas reserves in Petroleum Retention License 15 (PRL-15), located in Gulf Province, Papua New Guinea and piping them overland, then offshore in the Gulf of Papua, to the existing Papua New Guinea Liquefied Natural Gas Project (PNG LNG Project) producing and exporting facility (LNG Plant) located in Caution Bay (Central Province) approximately 20 km north-west of Port Moresby.

The existing PNG LNG Project commercialises gas reserves in the Hela, Western and Southern Highlands provinces of Papua New Guinea. The gas is transported to the LNG Plant via pipeline, where it is liquefied and exported by ship to international gas markets. The LNG Plant also currently supplies gas to the NiuPower Port Moresby Power Station and the Dirio Central Province Power Station (DCPPS) for the domestic electricity market.

The Papua LNG Project involves two components:

- The Papua LNG Project – Upstream (referred to as the Upstream component).
- The Papua LNG Project – Downstream (referred to as the Downstream component, hereafter referred to as “the Project” and the component addressed in this document).

Execution of the Upstream component and the Project is delimited in Caution Bay, with the approximate boundary (i.e., the scope break) between the components located near the fence of the LNG Plant, south of the existing jetty.

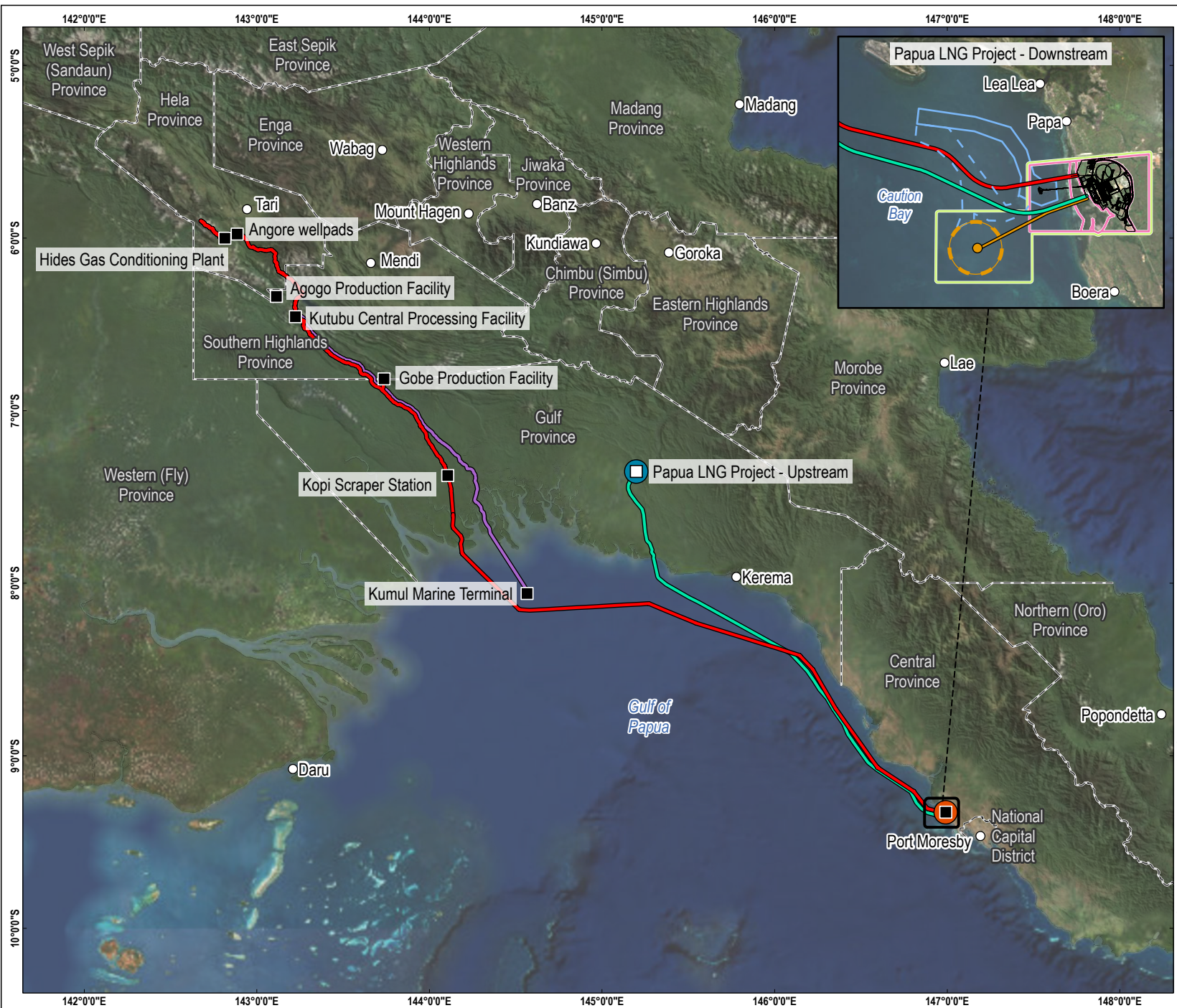
A summary of the components of the Project is provided in Table 1.1. The Project location is shown in Figure 1-1.

**Table 1-1. Project components at the LNG Plant**

| Component                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Additional LNG trains           | <p>New LNG processing trains and supporting systems including:</p> <ul style="list-style-type: none"> <li>• Inlet gas receiving and treatment</li> <li>• Dehydration/mercaptan removal</li> <li>• Mercury removal</li> <li>• Heavy-hydrocarbon separation (which contains benzene, toluene, ethylbenzene, and xylenes (BTEX))</li> <li>• Liquefaction</li> <li>• Stabilisation</li> <li>• Refrigeration system</li> <li>• Fractionation system (naphtha).</li> </ul>                                                                                                                                                                                                                                                             |
| Expansion of existing utilities | <p>Existing PNG LNG shared utilities to be expanded include:</p> <ul style="list-style-type: none"> <li>• Hot oil system</li> <li>• Service and instrument air system</li> <li>• Nitrogen system</li> <li>• Freshwater system</li> <li>• Desalinated water system</li> <li>• Potable water system</li> <li>• Diesel oil storage and distribution system</li> <li>• Open and closed drain systems</li> <li>• Sanitary wastewater treatment systems</li> </ul>                                                                                                                                                                                                                                                                     |
| New utilities                   | <p>Options for new separate utilities may include:</p> <ul style="list-style-type: none"> <li>• Integrated fuel gas system</li> <li>• Power generation system</li> <li>• Tempered water system</li> <li>• Highly demineralized water system for the Heat Recovery Steam Generators</li> <li>• Flare system (wet and dry gas)</li> <li>• Thermal oxidizer</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Product storage                 | <p>Product storage will include:</p> <ul style="list-style-type: none"> <li>• New condensate storage tanks with a total storage capacity of up to 110,000 m<sup>3</sup>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| New marine facilities           | <p>Marine facilities will include:</p> <ul style="list-style-type: none"> <li>• CALM buoy and associated exclusion zones</li> <li>• Pipeline end manifold (Upstream construction component, Project operations component)</li> <li>• Naphtha and condensate export pipelines (Upstream construction component, Project operations component)</li> <li>• New FEED pipelines including a gas pipeline and a condensate pipeline (Upstream construction component and Project operations component), with landfall and tie-in to the pipelines at the LNG Plant. The pipelines will be located south of the existing LNG Plant jetty.</li> <li>• Alternate shipping channel</li> <li>• Navigation and monitoring systems</li> </ul> |

## Papua LNG Project – Downstream | Community Health Baseline

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temporary facilities | Temporary construction facilities will be located within the PNG LNG Project's lease boundaries and will include laydown areas, offices, workshops and concrete batching plants.                                                                                                                                                                                                                                                                              |
| Waste                | Options being reviewed for waste facilities and management being assessed may include: <ul style="list-style-type: none"> <li>• Temporary onsite storage and segregation of waste, with transport to and disposal at third party waste management facility.</li> <li>• New engineered solid waste landfill within existing LNG Plant fence for disposal of non-restricted waste, with limited disposal of restricted waste by specialised service.</li> </ul> |
| Logistics route      | Most construction materials will be transported by truck from Motukea Port in Port Moresby to the LNG Plant site via the Lea Lea Road. Repairs or upgrades to the road, or relocation of overhead cables may be required to allow transport of large, heavy loads.                                                                                                                                                                                            |
| Workforce            | Construction: Approximately 5,000 to 7,000 personnel at peak.<br>Operation: Increase of approximately 50 operations and maintenance technicians with support staff anticipated to increase.                                                                                                                                                                                                                                                                   |
| Accommodation        | Construction: Up to 6,000 bed construction camps.<br>Operation: Up to 500 beds at the existing operations camp.                                                                                                                                                                                                                                                                                                                                               |



#### LEGEND

- Papua LNG Project - Downstream
- Papua LNG Project - Upstream
- Existing facility
- Province capital
- PNG LNG pipeline
- Proposed Papua LNG pipelines
- Santos oil pipeline
- Existing and proposed plant layout
- PPFL2 boundary
- APPFL boundary
- Province boundary
- Current navigational channel
- Proposed navigational channel
- Proposed CALM buoy components**
- CALM buoy
- Naphtha and condensate pipelines
- CALM buoy navigational area

**SOURCE**  
Infrastructure data from EMPNGA and Tetra Tech Coffey (indicative only).  
Place names from NGIA.  
Provinces from NSO.  
Imagery from ArcGIS Online.



0 50 100 km  
**SCALE 1:3,500,000**  
PAGE SIZE: A4  
PROJECTION: GCS WGS 1984

EXXONMOBIL PNG ANTELOPE LIMITED

PAPUA LNG PROJECT – DOWNSTREAM

#### FIGURE 1-1

**Papua LNG Project – Downstream Project location**



DATE: 04.07.23 PROJECT: 754-MELANS00733 FILE: 300733\_TSI01\_F01-01\_GIS

## **1.2 Objectives**

The following key objectives were established for the Community Health Baseline Report:

- Establish a general health profile for the LNG Plant villages.
- Provide a comparative local, district, provincial, and national analysis, as appropriate, and where data are available.
- Meet the requirements of the relevant standards outlined in the EIS.

## **2. Regulatory framework and standards**

This section provides background on how the assessment of community health fits into the EIS requirement for large-scale petroleum projects in Papua New Guinea.

### **2.1 National legislation**

Petroleum projects are regulated by the Oil & Gas Act 1998 (Independent State of Papua New Guinea 2001). Section 49 of the Act states that a socio-economic impact statement must be submitted by the proponent to the Minister (for petroleum) and Minister responsible for environmental matters before a development forum shall be convened. The government agency responsible for EIS/social impact assessment (SIA) regulation is the Conservation and Environmental Protection Authority (formerly the Department of Environment and Conservation).

Guidance in terms of the socio-economic impact statement is provided in the Environment Act 2000 (Independent State of Papua New Guinea 2004). Section 50 of the Act stipulates the need for an EIS for level 3 activities. Level 3 activities include petroleum activities requiring a Petroleum Development License or Pipeline License or activities requiring a Petroleum Processing Facility License (except for processing activities classified as level 2, category B).

Section 2 of the Act defines “environment” as including people and communities, human-made structures, and the social, economic, aesthetic, and cultural conditions which affect people and the environment.

The Department of Environment and Conservation (now Conservation and Environmental Protection Authority) prepared an information guideline (2004, 3-4) that states the EIS should include the following several parts:

- Characteristics of the receiving environment, including the social structure and socio-economic data on the resource/landowners, local level government (LLG), the Province, and Papua New Guinea, and which may include the following details:
  - Demographic information
  - Existing infrastructure information
  - Public health issues information (if applicable)
  - Present economic status of the project area
  - Description of existing social services
  - Details of archaeological, historical, cultural, or religious features of the project area under consideration
  - Environmental management, monitoring, and reporting, including information on a socio-economic management and monitoring strategy.

A working draft of the Social Impact Assessment Guideline was published by the Department of Environment and Conservation in 2001; however, it is not formally incorporated into the Environment Act. This draft discusses the interrelatedness of the social and biophysical environments and provides a list of key issues including “health”.

No other official guidance has been provided on what constitutes or is required for a social baseline or socio-economic impact assessment in Papua New Guinea. There is no formal statutory/regulatory requirement for performing a stand-alone health impact assessment (HIA).

## **2.2 National Health Development Objectives**

Papua New Guinea’s development approach for health has been outlined in the following plans and strategies, which are listed in chronological order:

- Papua New Guinea Vision 2050 (prepared 2008–2010) (National Strategic Plan Taskforce 2010)
- Papua New Guinea Development Strategic Plan 2010–2030 (Department of National Planning and Monitoring [DNPM] 2010)
- Papua New Guinea National Health Plan 2011–2020 (National Department of Health [NDOH] 2010a)
- Medium Term Development Plan III (MTDP) 2018–2022 (DNPM 2018)
- National Health Service Standards for Papua New Guinea 2011–2020 (NDOH 2011a)
- National Strategy for Responsible Sustainable Development for Papua New Guinea (StaRS) (DNPM 2014)
- 2014 National Human Development Report (United Nations Development Programme [UNDP] 2014)
- 2018 Human Development Indices and Indicators: 2018 Statistical Update (UNDP 2018)

### **2.2.1 Papua New Guinea Vision 2050**

For the years 2020–2050, the Vision 2050 strategy calls out the following key development projects:

- Better service delivery.
- Improved health services.
- Sound political leadership and structures.

The following specific health goals are identified in Vision 2050:

- Target a 20% level for health in terms of the Public Investment Budget Strategy.
- Ensure adequate access to health services.
- Ensure an adequate level of health infrastructure.
- Increase the role of churches in the provision of basic health services.
- Ensure that the referral hospitals are adequately equipped to international standards.
- Establish one aid post per ward area.
- Provide two health workers per ward area.

## Papua LNG Project – Downstream | Community Health Baseline

- Establish one basic health service centre with two doctors and support personnel per district.
- Improve the terms and conditions of employment of health officers.
- Reduce HIV and AIDS prevalence to 0.1 percent for the population aged 15–49.
- Reduce tuberculosis prevalence from 51 per 100,000 to 10 per 100,000 of the population.
- Reduce malaria deaths from 65 per 100,000 to 10 per 100,000 of the population.
- Establish a Health Endowment Fund.

Vision 2050 includes a goal of lifting Papua New Guinea into the top 50 countries in the United Nation's (UN) Human Development Index (HDI). The HDI was developed by the UN as a metric to assess the social and economic development levels of countries. Four principal areas of examination are used to rank countries: (1) mean years of schooling, (2) expected years of schooling, (3) life expectancy at birth, and (4) gross national income per capita. Papua New Guinea's 2021 HDI rank is 156 out of 191 countries (UNDP 2021).

### 2.2.2 Papua New Guinea Development Strategic Plan 2010–2030

The Strategic Plan's health goal is to “achieve an efficient health system which can deliver an internationally acceptable standard of health services” (DNMP 2010, 47). However, as noted in the Plan, many key health indicators have not significantly improved since the mid-1990s. This deterioration “coincided with the transfer of responsibility for rural health services to the local level government under the *Organic Law on Provincial and Local Level Government (1995)*” (DNMP 2010, 47). The following key causes in the overall health service decline are identified in the Plan:

- Poor access to quality health services and facilities such as specialist hospitals, aid posts, health centres and equipment—a situation made worse in the context of rapid population growth.
- Inadequate transportation infrastructure and other utilities, denying many people adequate access to health services.
- Law and order issues; for example, health facilities have been burned down or health workers have been attacked, resulting in the closure of service centres.
- Closure or limited operation of facilities due to shortage of staff (doctors, nurses, and community health workers), insufficient medicines, malfunctioning equipment, and poor building maintenance—approximately 50% of rural health facilities are not functional.
- Lack of emphasis on primary and preventative health practices, healthy lifestyles, and dietary practices.
- Poor management of the highly decentralised and fragmented National Health System, including failure by provincial governments to adequately resource health services through their annual budgets.

According to the Strategic Plan, achieving the key performance indicator targets for 2030 “will require a complete transformation of the health system” (DNMP 2010, 51). The Plan outlines the following strategies to develop the health system:

- **Management:** (1) Strengthen the capacity of management at all levels, including a clear demarcation of the functions of different levels of management and (2) centralize health services delivery through legislative changes and further reforms to the public health system.

- **Quality:** (1) Increase both the number and quality of health workers through better training; (2) upgrade and expand training facilities for medical practitioners, nurses, and community health workers; (3) modernize health facilities; and (4) establish bulk stores or warehouses, including an information technology network that will require all hospitals to monitor drug supply levels.
- **Access:** (1) Extend transportation, electricity, and utility services into rural areas; (2) ensure universal education, which will help people understand and address health issues; (3) recapitalize and upgrade existing health facilities; (4) develop strong partnerships with churches and other non-government organization (NGO) health service providers; (5) attract physicians to live and work in rural areas; and (6) develop outreach programs for rural populations.
- **Preventive health.** (1) Improve water and sanitation; (2) improve the immunization rate for vaccine-preventable diseases; (3) improve malaria and tuberculosis prevention programs; and (4) educate the population and encourage people to maintain healthy lifestyles.

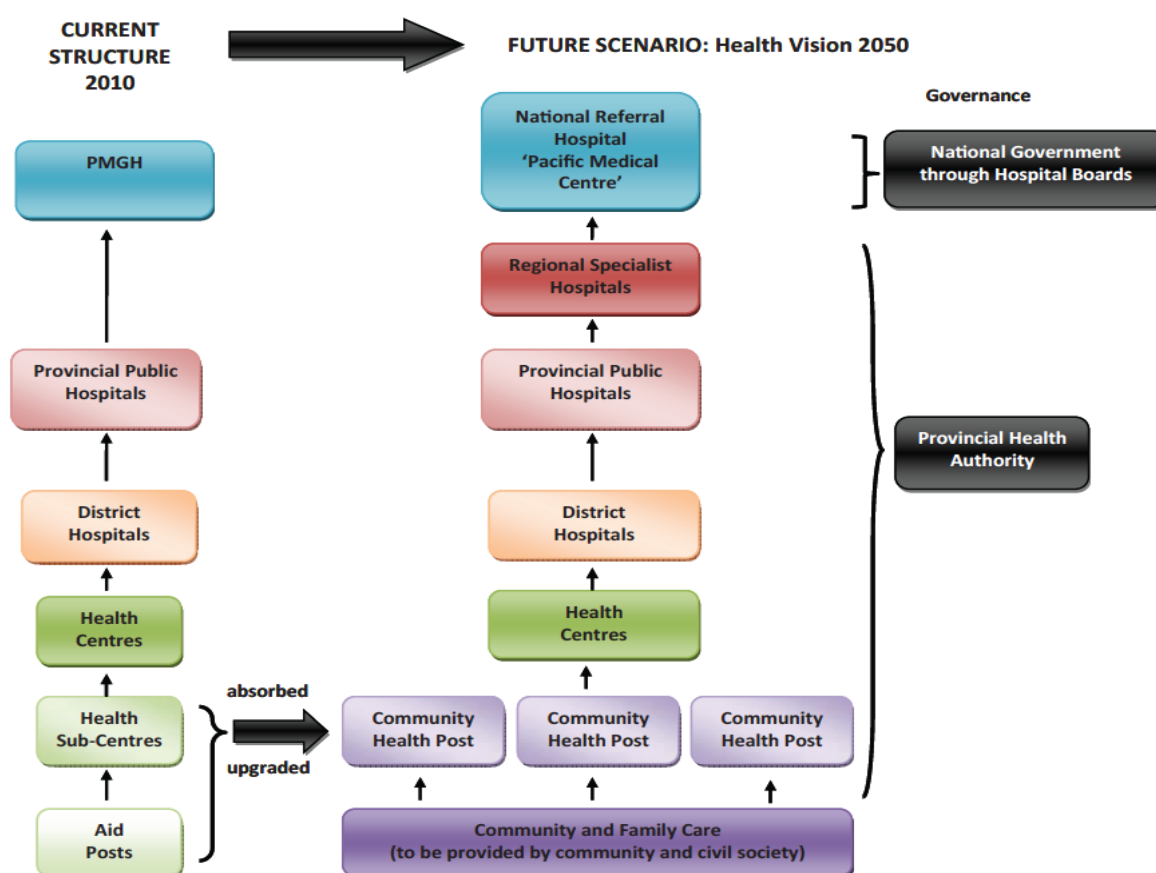
### 2.2.3 National Health Plan 2011–2020

The National Health Administration Act 1997 (Independent State of Papua New Guinea 1997, Section 4[2]) mandates the National Health Plan as the single governing policy document for the health sector. The 2011-2020 Plan is the sixth National Health Plan for Papua New Guinea since 1974.

The National Health Plan 2011–2020 (NDOH 2010a) is a high-level roadmap for improving rural health care delivery systems. The Plan focuses on improving service delivery, primary health care, and capitalizing on opportunities for improved health services. The organizational structure described in the plan is shown in Figure 2-1.

The Plan emphasizes a “back to basics” approach, meaning concentrating on improving primary health care for the rural majority and urban disadvantaged. The Plan defines what needs to be done, in what manner, for which reasons, and by which players to return to the basics and enable fundamental improvements to the health system.

Figure 2-1. National Health Plan 2011-2020, "Health Vision 2050"



Source: NDOH 2010a, Vol. 1, 18

The NDOH is responsible for policy, standard setting, technical advice, and monitoring. The National AIDS Council and its secretariat (NACS) are responsible for formulating policy and monitoring and coordinating the many actors involved in the HIV responses.

The Provinces and newly established Provincial Health Authorities (PHAs) are responsible for overseeing implementation, whilst service delivery is the ultimate responsibility of the Districts. Provincial responsibilities include delivering health programs in rural areas such as immunisation patrols and village birth attendant training; operating government rural health facilities; maintaining all health centre equipment; delivering drugs to all rural facilities; maintaining rural health infrastructure; and providing staff training. Provinces are also responsible for supporting provincial HIV committees; establishing voluntary counselling and testing sites; ensuring compliance with national standards; and distributing condoms and Antiretroviral Therapy (or Treatment) (ART) drugs, although most of these functions are currently being carried out by donors (World Bank 2014). On 14 October 2019, the Central Province PHA was formed and recognised by the Papua New Guinea NDOH as the No. 18th PHA (NDOH, 2019).

## 2.2.4 Medium Term Development Plan 2018-2022

The MTDP III, prepared by DNPM (2018), describes the resource envelope in which the National Government will operate over the 5-year period (2018–2022) and guides sector, provincial, district, and LLG plans.

The MTDP III describes the current Papua New Guinea health status: "PNG's health status is poor by global standards with health indicators and outcomes lagging. Considerable health inequalities exist

within the country. PNG has a relatively high maternal mortality, infant mortality, under-5 mortality and infectious diseases resulting from poor environmental conditions and childhood diseases” (DNPM 2018, 33).

According to the MTDP III, the Government’s plan is to make “quality health services accessible and efficient over the next five years” (DNPM 2018, 33). The MTDP has a series of key performance indicators (KPIs) described under the “Improve Health Services and Outcomes” goal. These KPIs are shown in Table 2-1.

**Table 2-1. Medium Term Development Plan health key performance indicators 2015–2030**

| Indicator <sup>1</sup>                          | Baseline <sup>2</sup> | 2022 Target |
|-------------------------------------------------|-----------------------|-------------|
| IMR                                             | 33 (DHS)              | 17          |
| U5MR                                            | 49 (DHS)              | 20          |
| MMR <sup>3</sup>                                | 171 (DHS)             | 175         |
| Tuberculosis incidence                          | 432 (MTDP)            | 150         |
| Malaria incidence                               | 105 (MDTP)            | 72          |
| 1-year-old measles vaccination proportion       | 37%(MDTP)             | 97%         |
| 1-year-old DTP-HepB –Hib vaccination proportion | 44%(MDTP)             | 97%         |

Source: DNPM 2018, 36; Papua New Guinea Demographic and Health Survey 2016-2018.

<sup>1</sup>IMR= infant mortality rate per 1,000 live births; U5MR= under 5 mortality rate per 1,000 live births; MMR= maternal mortality rate per 100,000; Tuberculosis incidence per 100,000 population; Malaria incidence per 1,000 population per year.

<sup>2</sup>Data as reported in the 2016–2018 Demographic Health Survey (DHS) or 2018 MTDP III.

<sup>3</sup>MMR data have been controversial in Papua New Guinea since 2006; the 2016-18 Papua New Guinea DHS reports a MMR of 171 (CI: 95-247). The pregnancy-related MMR is 20 (CI: 121-290).

### 2.2.5 National Health Service Standards for Papua New Guinea 2011–2020

The National Health Service Standards (NDOH 2011a) provide both a strategic overview for the provision of health care services and a guide for local health services planning. These standards are designed to:

- Provide service planning strategies/protocols;
- Inform financial and infrastructure planning;
- Clarify governance arrangements of services provided at national, provincial, and local level and by church-based organizations; and
- Ensure safe and quality care delivery and services.

The Standards are detailed and define the essential functions for aid posts, sub health centres, and health centres.

Rural aid posts comprise more than 70 percent of all health facilities and deliver basic health care including mother and childcare and community-based health promotion. Staffed by community health workers with 2 years of training, each aid post is designed to cover a population group of about 1,000. In the National Health Plan and Service Standards, health care in Papua New Guinea is envisioned as a hierarchical structure of seven levels with level one (aid post) as the least complex and level seven (national referral hospital) as the most complex.

Rural aid posts are intended to be the point of entry into the health system. Basic health care provided by aid posts in the LNG Plant villages varies by staffing, structures, medicines and supplies, transportation, and availability of a private confidential setting. To identify the operational status of health services in the LNG Plant villages in this report, facilities have been classified as operating, partially operating, or not operating. Operational services include trained staff that are recognised and paid by an organization (government and organizations such as The Salvation Army). Operational services have staff that is accessible full time; provide care in a confidential, private setting; and have a dedicated area where medicines and supplies are properly stored. Partially operating services either do not have staff available full time, have only volunteer staff who are not recognised by an organization, or do not have the facilities for appropriate private, confidential health care or storage of supplies. The status of these aid posts can change rapidly and frequently, so this information describes the situation at the time of field visits.

Where aid posts have closed or cannot provide adequate staff or medical supplies, sub health centres, health centres, and district hospitals have become the key primary care delivery facilities. Sub health centres and health centres provide similar services, including chronic and acute conditions management, basic surgical care, deliveries, and paediatric care, and function as intermediary referral points between aid posts and district hospitals. The differences between a sub health centre and a health centre are typically related to the size of the population served (a sub health centre serves 1 to 5,000 individuals while a health centre services 5 to 20,000 individuals).

In the decentralised Papua New Guinea health system, church groups often are responsible for staffing and managing sub health centres while the provincial government is responsible for named health centres. The status and performance of LNG Plant villages health care facilities are assessed in this baseline report.

### **2.2.6 National Strategy for Responsible Sustainable Development for Papua New Guinea**

StaRS includes 21 guiding principles for inclusive and innovative sustainable development that emphasizes, among other things, equality and inclusiveness, social protection, basic human rights, access to essential services, and education. “Health” is described in general terms—for example, “quality education for all and a world class health system are key elements...” (DNPM 2014, 24). There are also discussions on environmental health and climate change.

### **2.2.7 2014 National Human Development Report**

The most current, Papua New Guinea-specific UNDP report was published in 2014. The National Human Development Report notes, “the overall health situation in Papua New Guinea remains a cause for concern” (UNDP 2014, 42). As of 2014, while there are “marked regional variations and some modest progress in terms of decreased mortality and morbidity (ill-health), the strong economic growth in Papua New Guinea has yet to translate into significant<sup>1</sup> health status improvement for the population” (UNDP 2014, 42).

The 2014 review notes that overall mortality is driven by “preventable communicable and infectious diseases, and preventable pregnancy complications. Malaria, tuberculosis, vaccine-preventable

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<sup>1</sup> Significant – there are multiple meanings that are context dependent and commonly used by health professionals: (i) an adjective as having meaning or suggestive; (ii) an adjective as having influence or effect and (iii) in a statistical context suggesting some finding/effect is probably caused by something other than mere chance.

diseases and diarrhoeal/water-borne diseases are among the top-five causes of morbidity and mortality” (UNDP 2014, 42). The 2014 review highlights the following issues in Papua New Guinea:

- Lower respiratory infection (pneumonia) continues to be the leading cause of premature death.
- Malaria incidence has declined; however, it is still endemic in every province and is considered a significant burden on the health care system.
- Tuberculosis, including multi-drug resistant tuberculosis (MDR-tuberculosis), is rising dramatically. Treatment services lag far behind the clinical caseload. Accurate and timely diagnosis is a problem. Tuberculosis is a resource-intensive disease and requires substantial investment in personnel and service delivery.
- Cholera is a concern due to poor water sanitation and poor hand hygiene associated with infection in peri-urban settlements. Control measures are also made difficult by the remoteness of some affected sites and by the often-crowded settlements on the outskirts of cities with no proper sewage systems and deteriorated environmental health conditions.
- Maternal mortality is high with substantial uncertainty and controversy surrounding the actual underlying rate. According to the UNDP report, “Department of Health data indicates that the level of antenatal care has declined in the last 3 years in all regions, except in the Highlands region where it has slightly increased” (2014, 43). “Obstetric haemorrhage, sepsis and eclampsia are the main proximate cause of maternal death compounded by high anemia often associated with malaria. Although a majority of women received some antenatal care from a skilled health personal, on average only 53% of them deliver with the assistance of a skilled health care worker (rural: 48% and urban: 88%) and only 44% of births occur in a hospital or health center” (UNDP 2014, 43).
- Neglected tropical diseases are endemic—for example, leprosy is still diagnosed in the Central Province.
- Sexually transmitted infection (STI) prevalence is high and “remains a major challenge for the health authorities of Papua New Guinea, as increasing population movement, introduction of new pathogens, insufficient health services and wider and often denser socio-sexual networks engendered by rapid social change provide favourable conditions for their spread” (UNDP 2014, 44).

As noted in the report, “There has been a gradual decline in the percentage of functioning health facilities in some parts of the country over the past 20 years: in 2013 only around 70 per cent of aid posts are operational nationally” (UNDP 2014, 46). It also notes the health workforce is in decline.

The report states, “Papua New Guinea is facing a serious crisis in terms of human resources for health delivery, both in the numbers and skills mix. This shortage is a major obstacle to the provision of quality health care services” (UNDP 2014, 46). The 2014 National Human Development Report presents a health care system in significant decline.

Statistical updates to the UNDP reports were published in 2016 and 2018. The most current human development data (UNDP 2018) are presented in the next section.

### 2.2.8 Health Financing aspects

Main findings of the Papua New Guinea health financing system assessment by the World Bank include the following aspects ([World Bank report 2019](#)):

- Total Health Expenditure as a percentage of GDP relies predominantly on government spending, with low out of pocket spending.
- On average, 20 percent of total annual health spending in PNG is from development partners and funding levels, sources, and recipients are volatile.
- The increasing reliance on the Global Fund and the current transition from Gavi support raise issues of financial sustainability
- Gavi and the Global Fund programs currently rely on separate systems and human resources, which presents challenges for future support and integration.

### 2.2.9 Human development indices and indicators: 2021 Statistical Update: Papua New Guinea

The HDI is an average measure of basic human development achievements in a country. The HDI is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. A long and healthy life is measured by life expectancy. Knowledge level is measured by mean years of education among the adult population, which is the average number of years of education received in a lifetime by people aged 25 years and older, and access to learning and knowledge by expected years of schooling for children of school-entry age, which is the total number of years of schooling a child of school-entry age can expect to receive if age-specific enrollment rates stay the same throughout the child's life. Standard of living is measured by Gross National Income (GNI) per capita expressed in constant 2011 international dollars converted using purchasing power parity (PPP) conversion rates (UNDP 2018)

Papua New Guinea's most current (2021) HDI value is 0.558, which places Papua New Guinea in the low human development category, positioning it at 156 out of 191 countries and territories. Papua New Guinea pre-COVID-19 HDI trends based on the UNDP 2021 Statistical Update (UNDP 2021) are shown in Table 2-2. Papua New Guinea's 2021 HDI value is above average for countries in the low human development group but below average for countries in East Asia and the Pacific.

**Table 2-2. Papua New Guinea HDI Trends 1990-2017**

| Indicator                   | 1990  | 2000  | 2010  | 2015  | 2017  | 2021  |
|-----------------------------|-------|-------|-------|-------|-------|-------|
| Life expectancy at birth    | 58.9  | 61.8  | 64.6  | 65.4  | 65.7  | 65.4  |
| Expected years of schooling | 4.7   | 6.3   | 9.8   | 10.2  | 10.0  | 10.4  |
| Mean years of schooling     | 2.3   | 3.3   | 4.0   | 4.3   | 4.6   | 4.7   |
| GNI per capita (2011 PPP\$) | 1,867 | 2,694 | 2,872 | 3,371 | 3,403 | 4,009 |
| HDI value                   | 0.380 | 0.449 | 0.520 | 0.542 | 0.544 | 0.558 |

Source: UNDP 2021

## 2.3 Industry standards and international good practice

This section presents a review of information relating specifically to health baseline standards or requirements of the International Finance Corporation (IFC).

### 2.3.1 International Finance Corporation

Over the past two decades the IFC has applied environmental and social standards to projects it has financed. The adoption of the IFC standards under the Equator Principles greatly expanded their application. There are eight Performance Standards (PS), including PS 4 Community Health, Safety, and Security.

IFC PS 4 addresses the project proponent's responsibility to "avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups" (IFC 2012, 27). It states:

The client will avoid or minimize the potential for community exposure to waterborne, water based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups. Where specific diseases are endemic in communities in the project area of influence, the client is encouraged to explore opportunities during the project lifecycle to improve environmental conditions that could help minimize their incidence (IFC 2012, 29).

The client will avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labour (IFC 2012).

There is no specific IFC requirement that an HIA be performed; however, IFC has issued an HIA Toolkit (2009) and Guidance Notes for PS No. 4 that present detailed information regarding HIA design and execution.

### **2.3.2 International Petroleum Industry Environmental Conservation Association**

The International Petroleum Industry Environmental Conservation Association (IPIECA), established in 1974, aims to develop and promote socially and economically acceptable solutions to global environmental and social issues in the oil and gas industry. IPIECA has produced a range of good practice guidelines regarding HIAs. In terms of baseline health characterisation, the 2016 IPIECA HIA guidance recommends performing several steps:

- Review literature systematically by environmental health area.
- Evaluate existing country survey and research data.
- Evaluate data obtained by community and household survey teams (including environmental and social).
- Evaluate health data from existing project workers, if available in sufficient quantity.

The baseline collection of field data should be "fit for purpose," meaning data collection efforts should match the complexity and practical needs of the HIA and should not devolve into an academic exercise. Data should be relevant to the project and connected to the overall analysis of the project.

### **2.3.3 World Health Organization**

In 2014, the World Health Organization (WHO), in collaboration with the European Public Health Association and the International Association for Impact Assessment published a monograph called "Health in Impact Assessments—Opportunities not to be missed" (WHO 2014a). This publication was designed to "provide a detailed and balanced view on health in impact assessments." The monograph presents five key types of impact assessment: environmental impact assessment, strategic environmental assessment, social impact assessment, sustainability assessment, and HIA. It strongly notes the interdependencies between health and social/environmental assessment, and it presents pros and cons of a stand-alone HIA versus an integrated assessment. The WHO analysis "suggests that the potential of impact assessments to protect and promote health is underutilised, and represents a missed opportunity. Ways need to be found to exploit the potential to a fuller extent" (WHO 2014a, Abstract).

### 3. Study area

This section discusses the LNG Plant villages and study area for the Project.

The LNG Plant villages are the area that is likely to be affected by the Project, its activities, and its facilities that are directly owned, operated, or managed by the Project. The Project is an expansion of an existing facility. The LNG Plant villages are located within the Kairuku-Hiri District of Central Province, Hiri Rural LLG. This area encompasses land, infrastructure, and communities expected to experience some effects from the construction and operation of the Project. Landowner villages in the study area include Porebada, Boera, Papa, and Lea Lea<sup>2</sup>, in addition to Edai Town, a gated residential community approximately 3 km east of Boera.

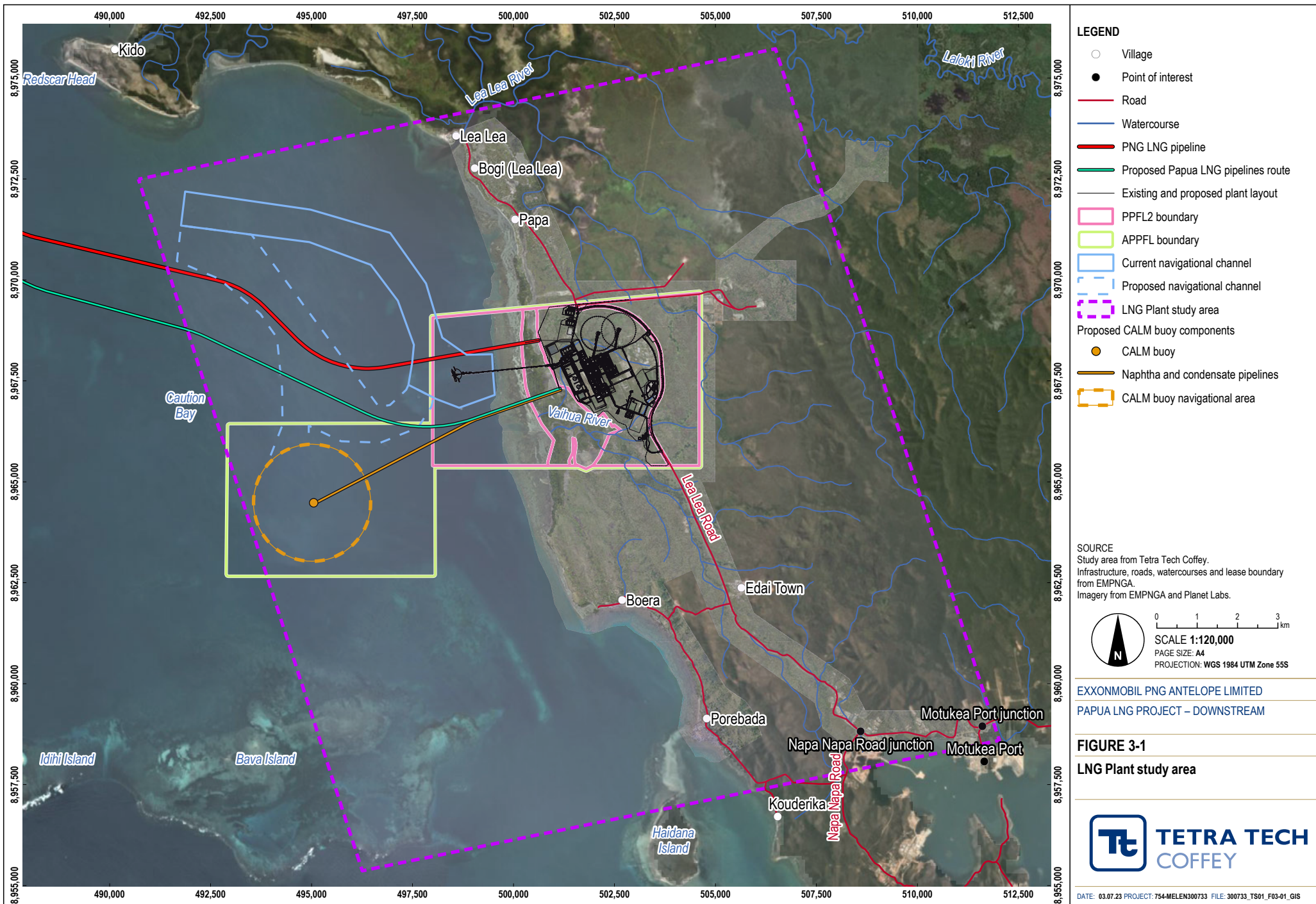
The LNG Plant Social Baseline (Appendix C of the Papua LNG Project – Downstream EIS) has also considered a National Study Area (the National Capital District, POM). As described in the LNG Plant Social Baseline, this study area may be influenced through project-derived revenue flows (taxes and royalties) to the Government of Papua New Guinea, economic growth-induced changes to gross domestic product, and business development and employment opportunities, particularly in POM. The National Study Area was not formally evaluated from a health baseline perspective, as potential project health effects are likely to minimally influence the underlying burden of disease for the National Capital District.

#### 3.1 Study area

The Baseline Community Health Report uses the geographical boundaries and key villages as defined by the social team in the Community and Demographics Baseline Social Report (Figure 3-1). Household survey and key informant interview (KII) data were collected from each of the four study area communities. Primary data were collected from the local health facilities that service these communities by the health team. In addition, KIIs focusing on health issues were conducted in the study area.

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<sup>2</sup> A portion of Lea Lea is often referred to as Bogi. This report includes Bogi as part of Lea Lea.



## 4. Existing information

Health data are available for Papua New Guinea; however, the volume, quality, and geographical coverage of the information are highly variable. The last countrywide DHS was implemented by the Papua New Guinea National Statistics Office from October 2016 to December 2018 and was released in November 2019 as a final report. The purpose of the DHS was to obtain and provide information on basic indicators of social progress including fertility, childhood mortality, reproductive and child health, nutritional status of children, and awareness of HIV/AIDS and other health-related issues. High-level summary results were released in May 2019 and are confirmed in the November 2019 final report. Key mortality results are presented in Table 2-1. Other relevant DHS data, such as percentage of households with water, sanitation, and electricity by residence and antenatal care, are presented in subsequent sections of this report. These data were not disaggregated below either urban or rural or at the regional level (Southern, Highlands, Momase, and Islands). The Central Province (home of the Project) is part of the Southern Region, which also includes the Gulf, National Capital District, Milne Bay, Oro, and Western provinces.

Health data are also available through the NDOH Sector Performance Annual Review (SPAR) reports. The most current SPAR report was published in 2022 and presents year 2020 data. While there are many national level reports, data are not always disaggregated at the provincial level, let alone at district or LLG levels.

Education and economic statistics, including information from the 2011 National Population and Housing Census (National Statistics Office [NSO] 2013a) and 2009–2010 National Income and Expenditure Survey (NSO 2013b), are available.

Multilateral agency (such as WHO and World Bank) reports typically report national level data that are rarely available at a provincial level, much less at a district level. Where relevant these data were reviewed and used.

Health data produced through the Papua New Guinea Institute of Medical Research (PNG IMR) Comprehensive Health and Epidemiological Surveillance System (CHESS) studies (2016–2018) are analysed as the surveillance sites included the PNG Hiri villages health facilities that had previously been part of the PNG LNG sponsored 2013–17 Partnership in Health Program (PiHP). The 2019–2020 PNG IMR national malaria survey was also used.

Beginning in 2019, the Papua New Guinea NDOH fully migrated health facility data to an electronic national health information system known as eNHIS (Rosewell et al. 2021). The LNG Plant Village health facilities, located in Papa and Porebada, are part of the eNHIS. Data from 2019–2021 eNHIS were collected and analysed. Data collected in the eNHIS are designed to match indicators in the SPAR reports.

COVID-19 data are available from the Papua New Guinea Joint Agency Task Force National Control Centre for COVID-19. The COVID-19 are only disaggregated at the provincial level—data are available for the Central Province but not at the reporting health facility level. Data as of 20 November 2022 are presented.

The following additional baseline data sources were used:

- Peer-reviewed scientific journal publications.
- Data from Porebada, Boera, and Papa health facilities.

- Multilateral funding agency data including the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), U.S. Agency for International Development (USAID), and the Australian Department of Foreign Affairs and Trade (DFAT).
- NGO data, such as Rotarians Against Malaria (RAM).

## 5. Methods

This section of the report discusses the methodology used to compile this report, including the general approach, data sources, limitations, and currency conversions.

### 5.1 General approach

The general approach to the Project health baseline characterization was to confirm the selection of study villages in the LNG Plant area, identify key health performance indicators, develop health-specific questions for inclusion in the household surveys conducted by the social teams, consult key stakeholders, compile and summarise data, and identify study limitations.

#### 5.1.1 Identify data requirements for health

Following a review of existing information, potential gaps in information that were required to present baseline health characterisations of the LNG Plant villages were identified. There are four sets of Hiri District specific data: (1) PNG IMR Partnership in Health studies 2013-2017; (2) PNG IMR CHES studies 2016–2018 that included Hiri District data (Papa and Porebada sub health centres data); (3) 2019 LNG Plant Village studies conducted by Tetra Tech Coffey and NewFields; and (4) eNHIS Hiri District data covering 2019–2021. The published PNG IMR 2013–2017 data are 5–10 years old and may not reflect the current post-COVID-19 pandemic LNG Village situation. The PNG IMR 2016–2018 data and 2019 NewFields and Tetra Tech Coffey field studies were pre-COVID-19 pandemic and may not fully reflect the current post-pandemic health situation. The eNHIS data are the standard national reporting data for health clinics, aligned with national SPAR data, and include the COVID-19 pandemic time period. The 2019–2021 eNHIS data provide the most longitudinal perspective on critical health outcomes for the LNG Plant villages. Hence, the eNHIS can be used for contemporary monitoring during the foreword phases (early works and active construction) of the Project.

The Papua New Guinea eNHIS captures monthly reporting and includes outcome, output, and process measures that are collected for all reporting clinics and summarised in published SPAR reports. The most current published SPAR report covers 2020 provincial level data; however, disaggregated province-level clinic specific data have been obtained by NewFields and are used in this report. The eNHIS does not capture data by patient provenance (the village of residence for the individual[s] seeking medical attention). Experience in Papua New Guinea indicates that the location of a health facility does not necessarily define patient catchment geography. In addition, visitors from outside the Hiri District can access the local clinics. Non-Hiri District visitors can impact reported disease data; for example, “imported” positive malaria cases. In addition, due to improved public transportation between the Hiri villages and POM, community members in the LNG Plant villages can readily access health facilities in the National Capital District, such as Port Moresby General Hospital. During the 2021/2022 national COVID-19 waves (April 2021, October 2021, and January 2022), there was no COVID-19 testing available at the Papa Sub Health Centre and minimal rapid antigen testing at Porebada Sub Health Centre. Symptomatic patients were referred to Port Moresby General Hospital (October 2022 personal communication ExxonMobil LNG Medical Team).

The following key eNHIS outcome, output, and process measures data were used for this baseline report:

- **OUTCOME Measures:**
  - Case fatality rate (in health facilities) for pneumonia in children under 5 years
  - Proportion (%) of underweight children under 5 years
  - Underweight (<2,500 gm) births as a percentage of total births
  - Incidence malaria per 1,000 population
  - Number of pregnant 15–24 year old women who test HIV+
  - Incidence diarrheal diseases per 1,000 children under 5 years
  - Total Injury discharges from health centres/hospitals per 1,000 population
- **OUTPUT Measures:**
  - Percentage of children at age 19–17 months immunised against measles
  - Third dose of pentavalent vaccine received
  - Percentage of births attended by skilled personnel at health facilities
  - Percentage of women who attended at least one antenatal clinic (ANC) visit
  - Family planning—couples protection per 1,000 women of reproductive age
- **PROCESS Measures:**
  - Average number of outpatient visits to hospitals and health centres per person per year

A comparison of specific outcome, output, and process measure eNHIS Hiri District health data to overall Central, National Capital District, and overall Papua New Guinea national data are shown in Table 6-23 in Section 6.5.1. Since 2019, the eNHIS has been transitioning the standard clinic reporting form; hence, some pre-2019 measures cannot be compared as the definition of the measure has changed.

Specific HIV and tuberculosis reporting data were obtained from NDOH and Central Province reporting systems. Antenatal HIV testing data are reported within the eNHIS. Tuberculosis surveillance test data were also obtained from the ExxonMobil LNG Medical Service, which operates a sophisticated tuberculosis testing surveillance system for employees including pre-employment screening.

Data collection methods used in the 2019 Hiri District field studies performed by Tetra Tech Coffey and NewFields included: (1) dedicated KIIs with health workers; (2) semi-structured community health discussions; (3) stakeholder health discussions with health services providers (government and health centre staff); and (4) specific health-related questions in the overall household survey implemented by the social team across a sample of households in the LNG Plant villages. A detailed presentation of the KII for both health workers and community members is presented in Section 6.4 of this report.

The health KIIs were conducted only where there was a health facility and/or health worker present. Health facilities (see Table 5-1) are located in Porebada (under relocation to a new facility and not yet functional at the time of the 2019 field work), Boera (functional but subsequently closed in January 2022), and Papa (functional). Additional KIIs were conducted with health staff at the Central Provincial Health Administration office also known as the “Hiri Clinic.” The Hiri Clinic provided immunisation services to the LNG Plant villages, and occasionally treated patients from these communities; however, this facility was destroyed by a fire 2 weeks before the KII was conducted.

**Table 5-1. Project area of influence health facilities 2019 field studies**

| Location       | Health facility            | Status                                      | Facility assessment conducted | KII participants                                  |
|----------------|----------------------------|---------------------------------------------|-------------------------------|---------------------------------------------------|
| Porebada       | Porebada Sub Health Centre | Closed                                      | No                            | Not Available                                     |
| Porebada       | New health facility        | Open, not operational                       | Yes                           | General discussion with staff and management      |
| Boera          | Boera Aid Post             | Operational in 2019; closed in January 2022 | Yes                           | Sana Mura, community health worker (CHW); retired |
| Papa           | Papa Sub Health Centre     | Operational                                 | Yes                           | Michael, health extension officer (HEO)           |
| Konedobu (POM) | Hiri District Clinic       | Not operational                             | No                            | General discussion with staff and management      |

### 5.1.2 Develop sampling framework

The LNG Plant Village’s household survey sampling strategy was developed by the Tetra Tech Coffey social team and is described in detail in the LNG Plant Social Baseline. Health-specific questions were included in all household surveys. The household health survey questions were developed to selectively update the existing and detailed database developed by PNG IMR from 2013 to 2018. The 2019 surveys were generally compatible and consistent with past survey efforts of the LNG Plant villages. Hiri District survey data are available beginning with the 2007/8 baseline Papua New Guinea LNG social surveys. In addition, NewFields had performed a pre-PNG LNG Project HIA and these data were available for review. NewFields believes that the 2019–2021 eNHIS are most representative of the current (2022) baseline situation for the LNG Plant villages.

### 5.1.3 Health study team

The health team assembled for the coordinated data collection program included two expatriate consultants. The health subject matter experts were Marci Balge RN, MSN, COHN-S<sup>3</sup> and Gary Krieger MD, MPH, DABT, DTM&H<sup>4</sup>. They each have extensive (more than 15 years) experience in

3 Registered Nurse (RN), Masters of Science in Nursing (MSN), Certified Occupational Health Nurse-Specialist (COHN-S).

4 Medical Doctor (MD), Masters in Public Health (MPH), Diplomate of the American Board of Toxicology (DABT), Diploma in Tropical Medicine and Hygiene (DTM&H).

Papua New Guinea and have worked on numerous health projects in the country, including the 2008 HIA for the PNG LNG Project.

The health members reviewed and analysed all health-related data collected during the surveys. Community and household health survey data are presented and analysed in this baseline report. Broader social data relevant to the health baseline, such as demography, literacy, and drug and alcohol use, are presented in summarised form and cross-referenced to the relevant chapter in the social baseline report.

### 5.1.4 Social and health surveys

The social and health study teams conducted multiple field investigations that included community level and household level surveys as well as semi-structured topic specific discussions with community members and relevant public officials (see Table 5-1). The LNG Plant Social Baseline presents a discussion regarding the survey design and data collection efforts. The health discussions aimed to explore challenges and potential emerging issues, supplementing the information gained from the surveys.

## 5.2 Limitations

The health team identified the following main study limitations:

- Identifying functioning health facilities within the LNG Plant villages; for example, the Porebada Sub Health Centre was in a state of transition migrating from an old facility to a new building.
- The Porebada Sub Health Centre has not always been open and staffed; therefore, there can be reporting gaps for monthly tally sheets particularly pre-2019 data.
- The Boera Clinic reported its data through the Porebada Sub Health Centre. The Boera Clinic closed in January 2022.
- The provenance of patients is not documented for any clinical encounters at Hiri health facilities; therefore, it is impossible to disaggregate morbidity data by individual Hiri village.
- Data regarding smoking, drug, alcohol usage, STIs, and gender-based violence are sensitive and may be underreported.
- Cause of death mortality data are not reported by Hiri health facilities.

## 6. Baseline characterisation

This section describes the methodology for organizing and presenting the baseline health data.

### 6.1 Methodology for organising baseline health data

The overall baseline data are presented in the following sequence:

1. A demographic overview of the LNG Plant villages individually and as a combined dataset based on 2013–2018 PNG IMR surveys and the 2019 household survey conducted by the Tetra Tech Coffey social team.
2. A general overview of the morbidity burden of disease for the LNG Plant villages. This analysis is based on eNHIS data and the responses from the household survey.

3. Stakeholder concerns based on KII of health workers and general community members. The KII interview data were primarily focused on health; however, some social concerns were raised by informants, such as, income, employment, and education opportunities. The expressed health concerns are organised by environmental health areas (EHAs).
4. Data presentation and analysis using the established environmental health framework (EHA). These data are derived from eNHIS, and a variety of surveys and studies conducted by the Government of Papua New Guinea, NGOs, PNG IMR, academic researchers, and Tetra Tech Coffey (2019 household and village survey).

The EHA methodology has been published by IFC (2009) and IPIECA (2016). EHAs are a standard set of health effects categories that have been developed by international multilateral lending institutions and the oil and gas industry. EHAs have been developed to capture a variety of determinants and outcomes for health. The EHA approach includes all the biomedical and social concerns originally developed by key international health and development agencies—WHO and the World Bank Group. Health data were organised into the following 12 EHAs:

1. **Health systems** – physical health infrastructure (such as capacity, equipment, staffing levels and competencies, and future development plans) and program management delivery systems (such as malaria, tuberculosis, and HIV/AIDS initiatives and maternal and child health).
2. **Communicable respiratory diseases** – transmission of communicable diseases (such as acute respiratory infections (ARIs), pneumonia, tuberculosis and meningitis) that can be linked to inadequate housing design, overcrowding, and housing inflation.
3. **Vector-borne diseases (VBD)** – mosquito-, fly-, tick-, and lice-related diseases, such as malaria, dengue, and yellow fever.
4. **STIs, including HIV/AIDS** – STIs such as syphilis, gonorrhoea, chlamydia, hepatitis B, and, most importantly, HIV/AIDS.
5. **Water, Sanitation, and Hygiene (WASH)-related diseases** – diseases that are transmitted directly or indirectly through contaminated water, soil, or non-hazardous waste (such as diarrhoeal diseases).
6. **Food- and nutrition-related issues including food security** – adverse health effects such as malnutrition, anaemia, or micronutrient deficiencies due to changes in agricultural and subsistence practices or food inflation; gastroenteritis; and food-borne trematodiasis, among others.
7. **Non-communicable diseases (NCD)** – cardiovascular diseases, cancer, diabetes, and obesity.
8. **Accidents and injuries** – road and marine traffic- or work-related accidents and injuries (home and project related).
9. **Exposure to potentially hazardous materials** – includes exposure to pesticides, heavy metals, solvents or spills, and releases from road traffic. Noise, water, and air pollution (indoor and outdoor) as well as visual impacts are considered based on data developed in upstream baseline reports.
10. **Social determinants of health (SDH)** – includes psychosocial stress (due to resettlement, overcrowding, political or economic crisis, mental health, depression, gender issues, and domestic violence).
11. **Veterinary medicine and zoonotic diseases** – diseases affecting animals (such as bovine tuberculosis, swinepox, and avian influenza) or that can be transmitted from animal to human (such as, influenza A subtypes H5N1 and leptospirosis).
12. **Cultural health practices** – role of traditional medical providers, indigenous medicines, and unique cultural health practices.

## 6.2 Demographic data summary

This section discusses the overall population data as well as population structure.

### 6.2.1 Overall population data

The core population data and growth rates for the Central Province are shown in Table 6-1. These data are based on published Papua New Guinea NSO figures from 1980 through the most current national census of 2011. A July 2021 census was planned; however, due to the COVID-19 pandemic has been deferred to 2024 (NSO, 2021).

**Table 6-1. Central Province population growth rates**

| Population |         |         |         | Average Annual Growth Rate (%) |           |           |
|------------|---------|---------|---------|--------------------------------|-----------|-----------|
| 1980       | 1990    | 2000    | 2011    | 1980–1990                      | 1990–2000 | 2000–2011 |
| 116,964    | 141,195 | 254,158 | 269,756 | 1.9%                           | 2.6%      | 3.5%      |

Source: Papua New Guinea NSO 2013a

The Central Province growth rate of 3.5% is higher than the national average of 3.1%. Approximate growth rates are calculated based on an 11-year interval between the 2000 and 2011 national census surveys.

National census data are available from 2000 and 2011 for the four key LNG Plant villages. These data are shown in Table 6-2. The 2011 National Census data are controversial in terms of overall accuracy and should be cautiously considered (Bourke and Bryant 2021).

**Table 6-2. Papua New Guinea national census population/household data 2000 and 2011 LNG Plant villages**

|                                       | Porebada | Lea Lea | Boera | Papa  | Total LNG Village Population | Average Papua New Guinea Household Size |
|---------------------------------------|----------|---------|-------|-------|------------------------------|-----------------------------------------|
| <b>Year 2000</b>                      |          |         |       |       |                              |                                         |
| Population                            | 4,510    | 1,978   | 1,310 | 959   | 8,757                        | -                                       |
| No. of Households                     | 479      | 212     | 155   | 114   | 962                          | -                                       |
| Average Household Size                | 9.4      | 9.3     | 8.5   | 8.4   | -                            | 9.1                                     |
| <b>Year 2011</b>                      |          |         |       |       |                              |                                         |
| Population                            | 6,607    | 3,553   | 2,243 | 1,923 | 14,326                       | -                                       |
| No. of Households                     | 662      | 354     | 236   | 180   | 1,432                        | -                                       |
| Average Household Size                | 10.0     | 10.0    | 9.5   | 10.7  | -                            | 10.0                                    |
| Average Annual Population Growth Rate | 3.5%     | 5.3%    | 4.9%  | 6.3%  | 4.5%                         | -                                       |

Source: Papua New Guinea NSO 2013a

As observed in Table 6-2, there was a substantial population growth rate (across the key LNG Plant villages) that was greater than the national growth rate of 3.1%. The combined LNG village growth rate is consistent with the 2000–2011 Hiri Rural District rate of 4.6%. Average Papua New Guinea census survey household sizes in 2011 (10.0) were greater than the Central Province average of 6.5 or the Hiri Rural District average of 8.5. Based on the national census data, the average household size increased over the reporting decade.

As part of the PiHP, a series of full Hiri village population enumeration was carried out and reported by PNG IMR over the 2011–2017 time period. The initial Hiri census began in March–June 2011 with subsequent follow-up rounds in November–December 2011 and August–September 2012. PNG IMR issued an initial preliminary PiHP in September 2012 that captured these data. The final PNG IMR Hiri census was conducted beginning in June 2017 and completed in December 2017.

The sequential Hiri census data are presented in Table 6-3 and cover 2011–2017. For cross-reference consistency, the data are shown by PMG IMR report date. The March 2018 PNG IMR report covers work from June–December 2017. Hence, the March 2018 PNG IMR census data represent information collected and analysed from June–December 2017. The March 2018 report did not provide the number of households per village; however, the overall number of households for all four villages was reported. Based on the PNG IMR data the average household size across the villages held constant. However, the 2015 data indicated a marked difference in average household size by village.

**Table 6-3. Papua New Guinea Institute of Medical Research LNG Village census data 2011–2018.**

|                        | Porebada | Lea Lea | Boera | Papa  | Total Pop. | Average Papua New Guinea Household Size |
|------------------------|----------|---------|-------|-------|------------|-----------------------------------------|
| <b>September 2012</b>  |          |         |       |       |            |                                         |
| Population             | 5,109    | 3,014   | 1,733 | 1,675 | 11,531     | -                                       |
| Number Households      | 582      | 343     | 245   | 177   | -          | -                                       |
| Average Household Size | 8.8      | 8.8     | 7.1   | 9.5   | -          | 8.6                                     |
| <b>September 2015</b>  |          |         |       |       |            |                                         |
| Population             | 5,373    | 3,378   | 1,769 | 1,667 | 12,187     | -                                       |
| Number Households      | 676      | 468     | 319   | 228   | -          | -                                       |
| Average Household Size | 8.0      | 7.2     | 5.5   | 7.3   | -          | 7.2                                     |
| <b>March 2018</b>      |          |         |       |       |            |                                         |
| Population             | 5,915    | 4,400   | 2,574 | 1,741 | 14,630     | -                                       |
| Number Households      | -        | -       | -     | -     | -          | 7.2                                     |

Source: Papua New Guinea IMR PiHP Reports (2012, 2015, 2018). Two additional population data sets from 2019 are also available: Tetra Tech Coffey household survey (a proportionate to population sampling) and the RAM Central Province household census that included the four LNG Plant villages.

Table 6-4 presents the population estimates of the LNG Plant villages based on the 2019 Tetra Tech Coffey survey.

**Table 6-4. Population estimates of the LNG Plant villages**

| Village      | Mean number of residents per household <sup>1</sup> | Number of households <sup>2</sup> | Estimate of total population |
|--------------|-----------------------------------------------------|-----------------------------------|------------------------------|
| Porebada     | 9.21                                                | 781                               | 7,193                        |
| Boera        | 7.75                                                | 410                               | 3,178                        |
| Papa         | 8.30                                                | 291                               | 2,415                        |
| Lea Lea      | 8.10                                                | 565                               | 4,577                        |
| <b>Total</b> |                                                     | <b>2,047</b>                      | <b>17,363</b>                |

Source: Tetra Tech Coffey LNG Plant Social Baseline, Section 4.1.2

<sup>1</sup> Tetra Tech Coffey household survey 2019

<sup>2</sup> As determined by analysis of aerial imagery from 2017 to 2018

The RAM 2019 census data are shown in Table 6-5.

**Table 6-5. LNG Plant villages census**

| Village      | Mean number of residents per household | Number of households | Estimate of total population |
|--------------|----------------------------------------|----------------------|------------------------------|
| Porebada     | 8.25                                   | 872                  | 7,195                        |
| Boera        | 7.00                                   | 421                  | 2,949                        |
| Papa         | 8.00                                   | 299                  | 2,402                        |
| Lea Lea      | 7.50                                   | 572                  | 4,286                        |
| <b>Total</b> |                                        | <b>2,164</b>         | <b>16,832</b>                |

Source: RAM 2019a

According to the LNG Plant Social Baseline, it is difficult to assess population data from the different surveys, as collection strategies were different; nevertheless, there is a remarkable consistency between the 2019 Tetra Tech Coffey and RAM population estimates (within 3%). The household size per village is generally consistent between the Tetra Tech Coffey and RAM survey although the Tetra Tech Coffey estimates are consistently higher.

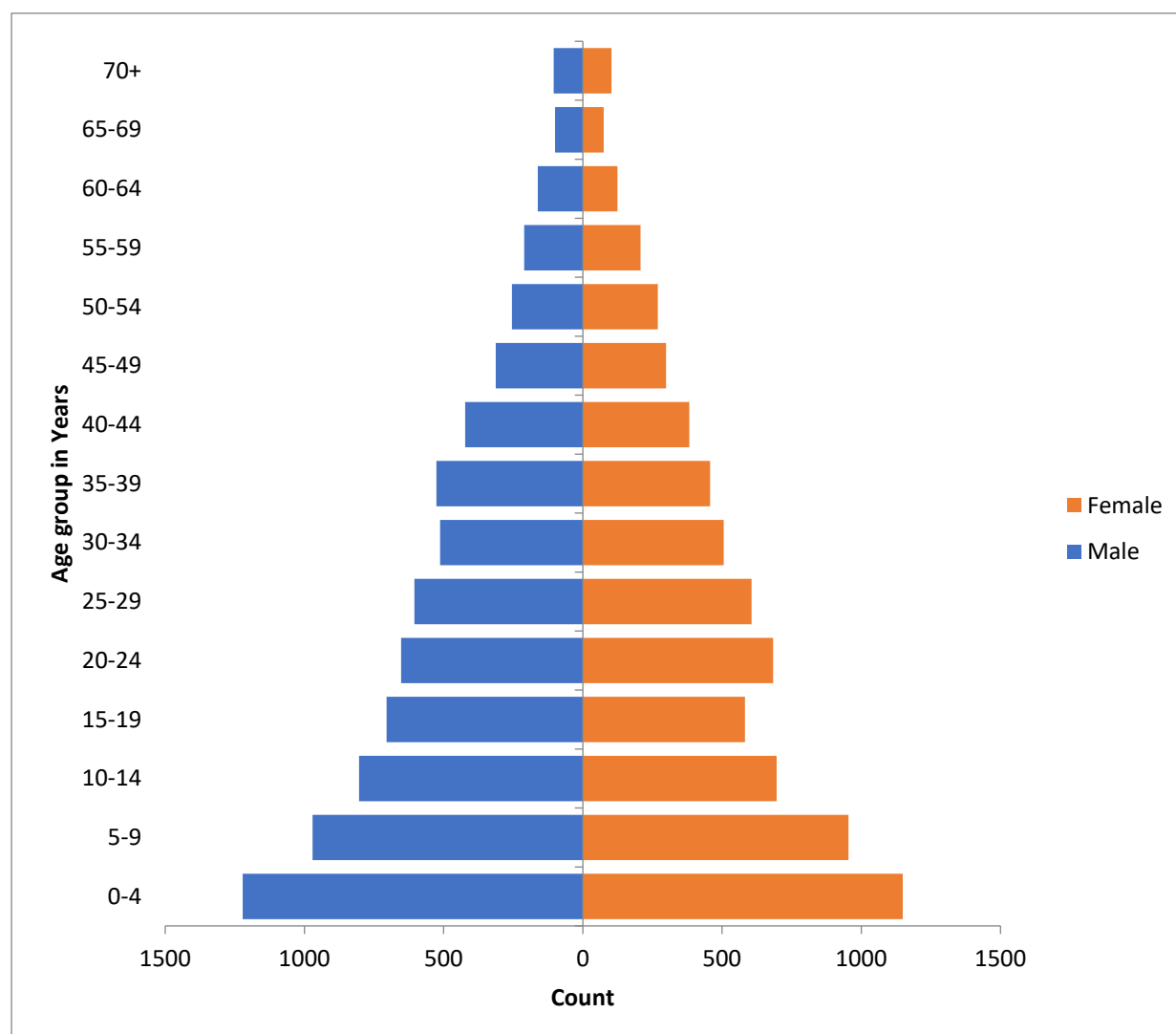
## 6.2.2 Population structure

A population pyramid illustrates the age and sex structure of a country's population and may provide insights about political and social stability, as well as economic development. The population is distributed along the horizontal axis, with males shown on the left and females on the right. The male and female populations are broken down into 5-year age groups represented as horizontal bars along the vertical axis, with the youngest age groups at the bottom and the oldest at the top. The shape of the population pyramid gradually evolves over time based on fertility, mortality, and migration trends.

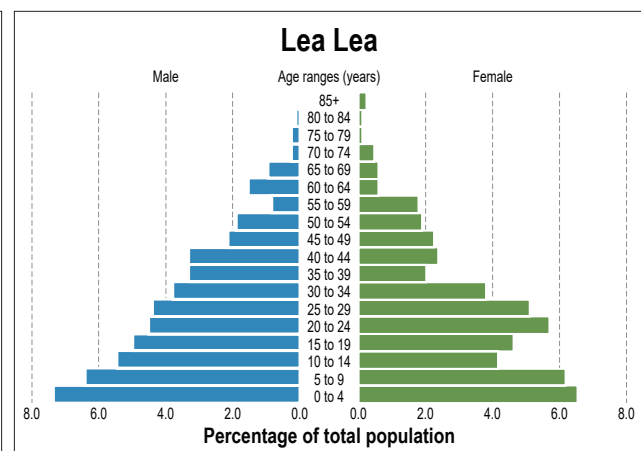
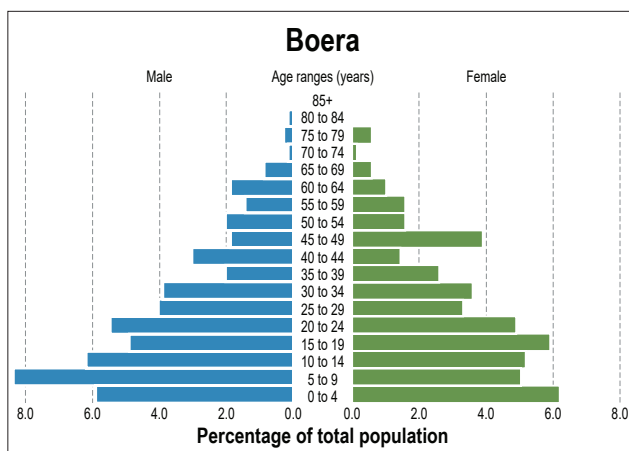
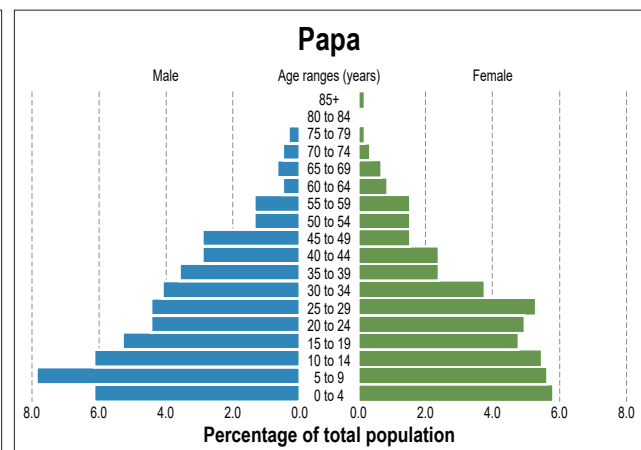
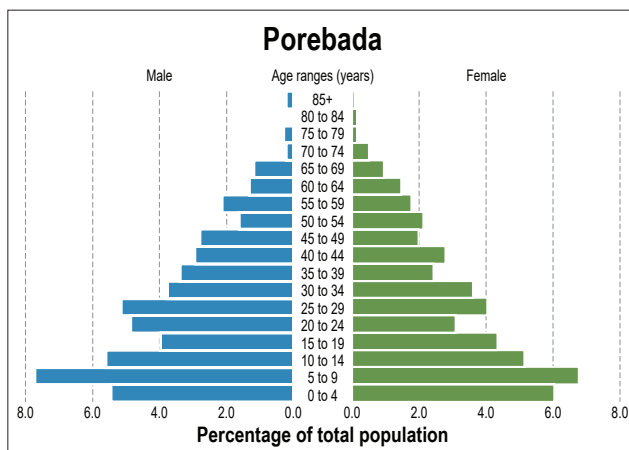
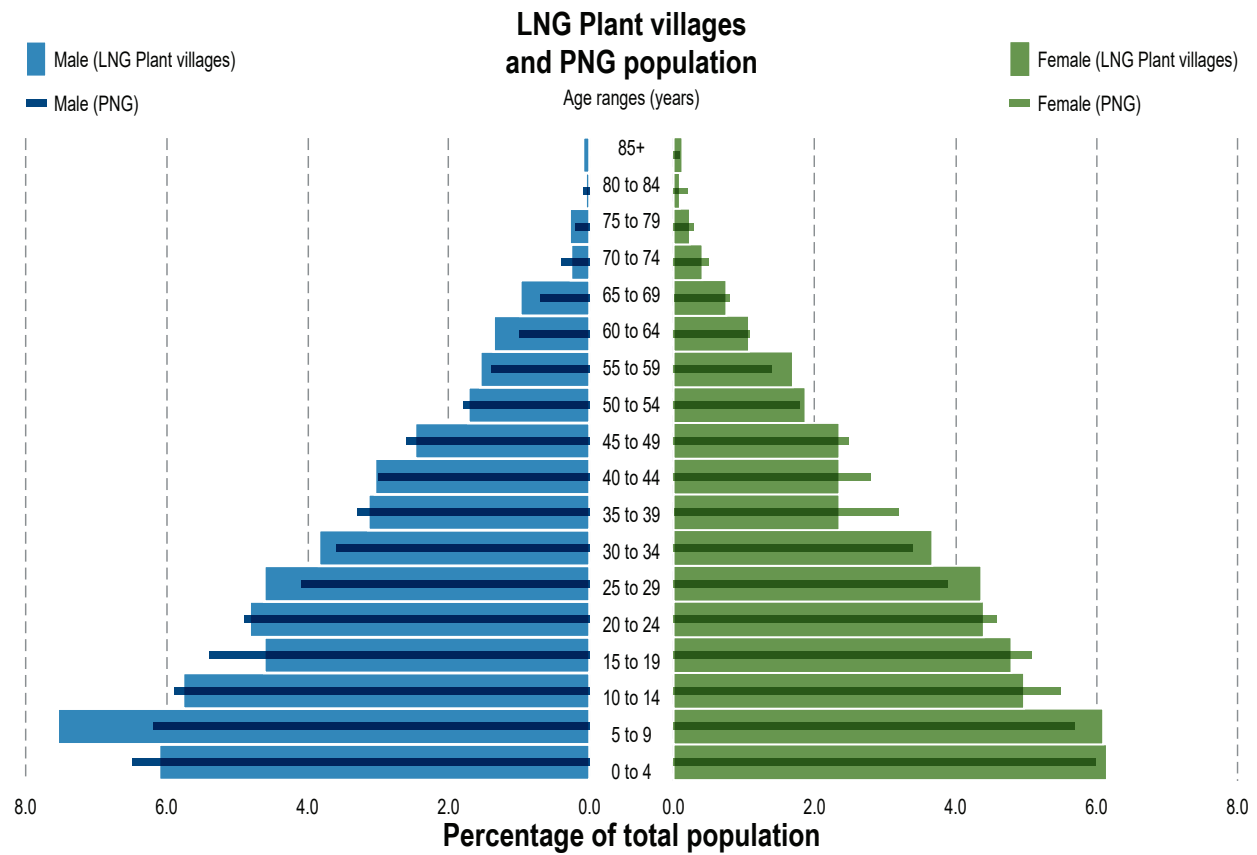
The age and sex population structure for each LNG Plant Village and as a combined total was determined by PNG IMR in their end of December 2017 census (March 2018 report) and as part of the 2019 Tetra Tech Coffey household survey. Figure 6-1 presents the overall Hiri population pyramid as determined by PNG IMR. The overall PNG IMR 2017 Hiri District LNG Plant Village population pyramid is typical for a young population with a high growth rate and consistent with both the 2019

Tetra Tech Coffey survey and the 2016–2018 Papua New Guinea national population pyramid shown in Figure 6-2 and Figure 6-3, respectively.

**Figure 6-1. Combined 2017 Papua New Guinea Institute of Medical Research Hiri villages population pyramid**



Source: PNG IMR 2018



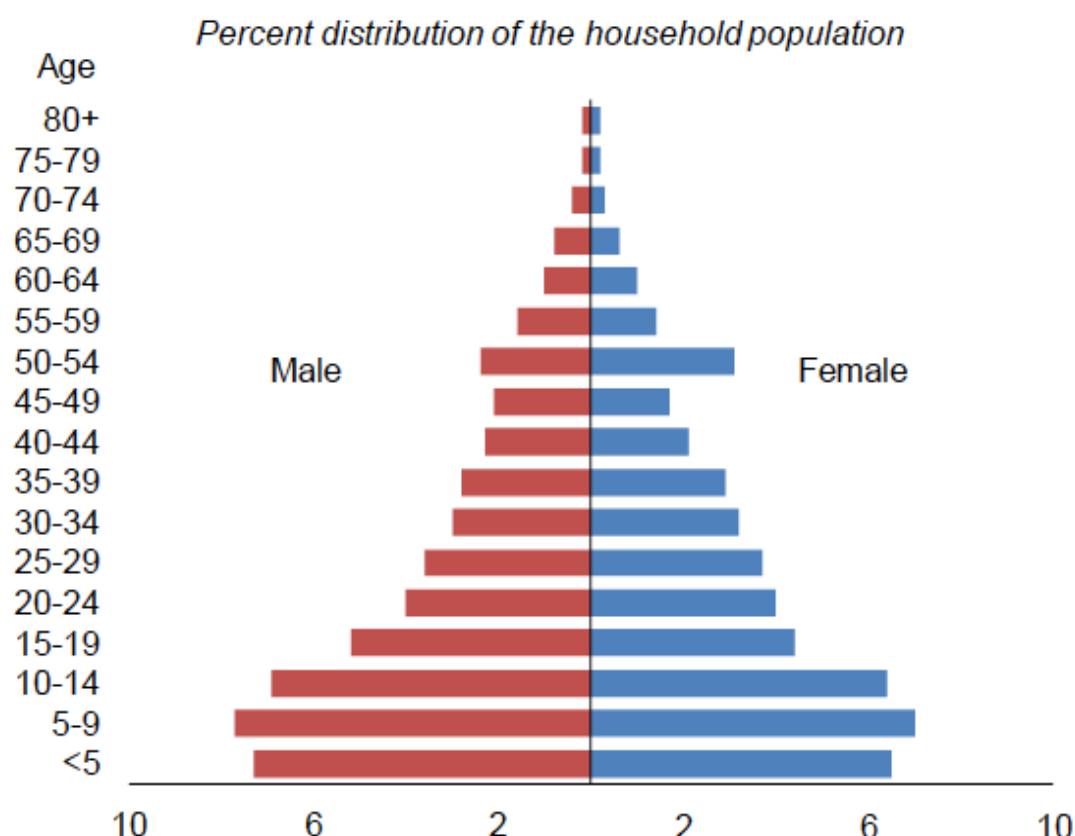
**FIGURE 6.2**  
**Population pyramids - LNG Plant villages**

SOURCE  
Tetra Tech Coffey household survey, 2019



DISCLAIMER: THIS FIGURE HAS BEEN PRODUCED FOR INTERNAL REVIEW ONLY AND MAY CONTAIN INCONSISTENCIES OR OMISSIONS. IT IS NOT INTENDED FOR PUBLICATION.

**Figure 6-3. Papua New Guinea national population pyramid (2016-2018)**



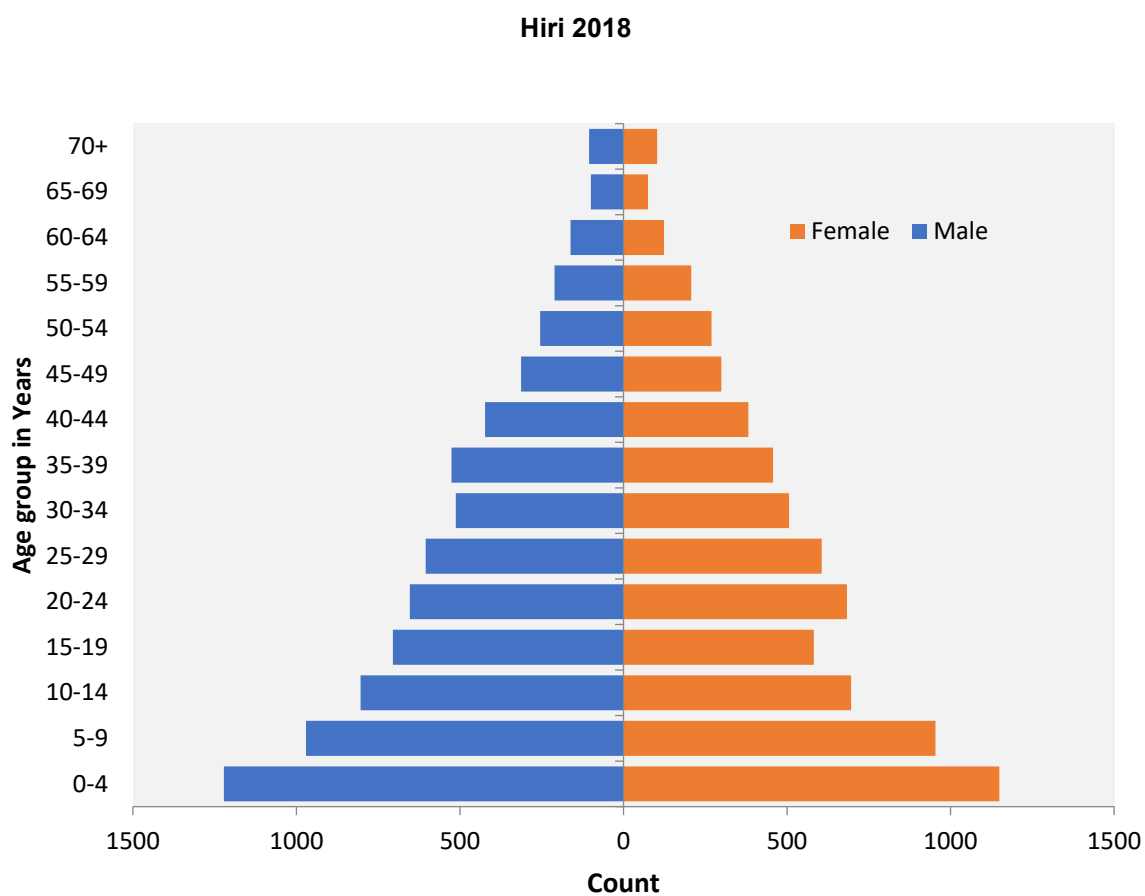
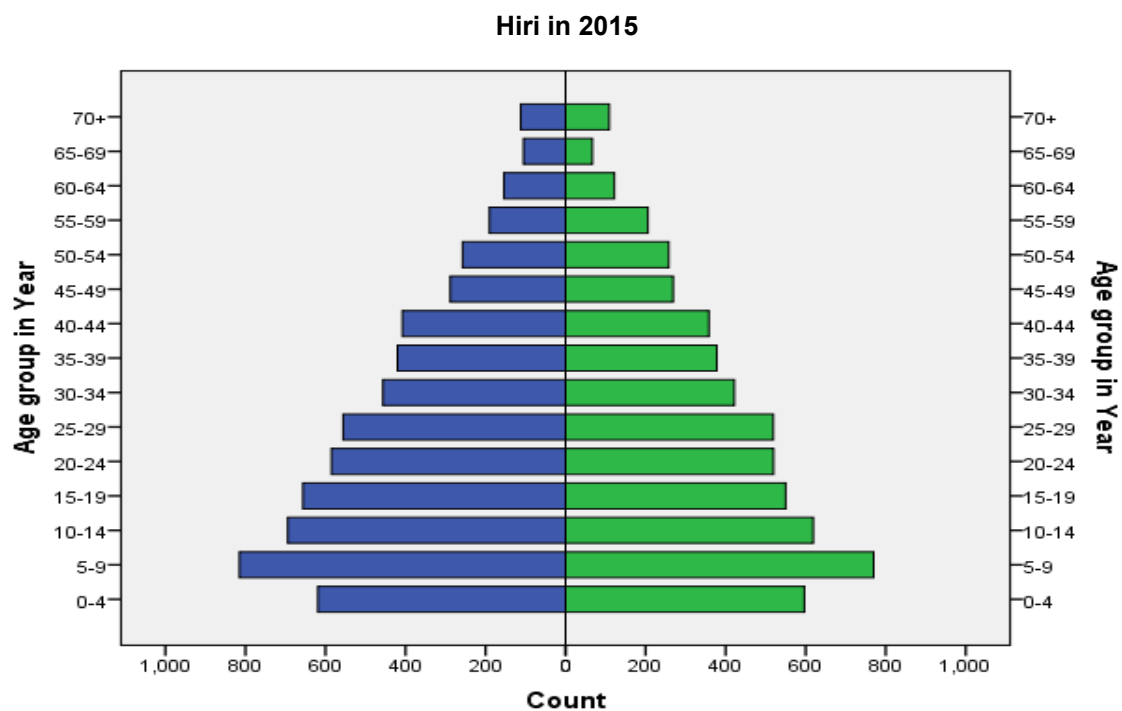
Source: NSO and ICF 2019a; Figure 2.4)

Note: X-axis shows percent (0–10)

A comparison of the LNG Plant Village population pyramid from the PNG IMR 2015 and 2018 reports indicates changes in the overall population structure (see Figure 6-4): an increase of the child population aged 0–4 years, as reflected in the longer bar at the bottom of the 2018 pyramid. While it is possible that undercounting occurred during the 2015 census, it is more likely that the fertility has increased in the last 3 years, resulting in a larger number of children being born. This is also consistent with the population census data presented in the previous section.

The 2018 population closely matches the national Papua New Guinea structure documented in the current November 2019 DHS, which was a national survey undertaken from 2016 to 2018 (see Figure 6-3). In the 2016-2018 DHS population pyramid, children under age 15 represent 42% of the population, while individuals age 15–64 represent well over half of the population (55%). Only 3% of Papua New Guineans are age 65 or older. The 2019 Tetra Tech Coffey survey also appears to confirm that the overall villages are now mirroring the overall Papua New Guinea national profile—a young high growth, high fertility pattern. The previously presented RAM census did not provide age-sex breakdowns.

Figure 6-4. Hiri District LNG Plant villages population pyramids 2015 and 2018



Source: PNG IMR 2018

An age and sex ratio segment comparisons across the 2017 PNG IMR census, 2019 Tetra Tech Coffey survey, and estimated 2018 national data are shown in Table 6-6. The sex ratio is the number of males: females in a defined age segment. The total dependency ratio (DR) is also included. The total DR is the ratio of dependents—people younger than 15 or older than 64 combined to the working-age population—those ages 15–64.

**Table 6-6. Population age, sex ratios, and dependency ratios comparison**

|                             | National 2018* | Tetra Tech Coffey 2019 | PNG IMR 2017 |
|-----------------------------|----------------|------------------------|--------------|
| Population Ages 0-14        | 35.6%          | 36.3%                  | 39.5%        |
| PopulationAges15-64         | 60.5%          | 60.2%                  | 57.9%        |
| Population> age 65          | 3.89           | 3.3%                   | 2.6%         |
| Sex Ratio M:F<br>Ages 0-14  | 104:100        | 112:100                | 107:100      |
| Sex Ratio M:F<br>Ages 15-64 | 104:100        | 108:100                | 106:100      |
| Sex Ratio M:F<br>Ages >65   | 106:100        | 107:100                | 115:100      |
| <b>Total DR</b>             | <b>66</b>      | <b>65.8</b>            | <b>72.7</b>  |

\*<https://countryeconomy.com/demography/population-structure/papua-new-guinea> (estimated)

In general, there is general alignment between the PNG IMR, Tetra Tech Coffey, and national estimates, including the 2016-18 DHS data for the overall population age structure; however, there are noticeable differences for the sex ratios across surveys, particularly compared to the Papua New Guinea national data.

The high male:female (M:F) sex ratios relative to national Papua New Guinea data have been previously noted by PNG IMR; however, the underlying cause was not identified. Based on the PNG IMR data, at the individual village level, there are also potentially significant sex ratio differences across specific age groups. For example, Papa village had a considerably higher proportion of females than males in the age group of 20–24, 54.7% vs. 45.3% (121:100 M:F), but higher proportion of males than females in the age group of 25–29, 60.7% vs. 39.3% (155:100 M:F), respectively. However, these individual village level sex ratios should be cautiously interpreted due to small numbers.

### Summary

- **LNG Hiri Village demography is consistent with a young and growing population.**
- **The combined 2019 LNG Plant Village population is approximately 17,000.**

## 6.3 LNG Plant villages burden of disease: Morbidity and mortality

This section discusses the morbidity and mortality data for LNG Plant villages.

### 6.3.1 Morbidity data

This section constructs a pre-COVID-19 morbidity (illness) and mortality (death) baseline using 2013–2018 data for the LNG Plant villages. This general burden of disease picture has been developed by collecting and analysing health service provider (clinic) data and using household surveys that asked standard questions regarding the presence or absence of illness symptoms among respondents. Cause of Death (COD) data are not available at a local clinic level; hence, overall national data are presented based on published literature studies.

The 2019–2021 eNHIS clinic data are reported using different definitions for some outcome and output measures (for example, measles vaccination is reported as 8–17 months versus <9 months) and are not fully aligned with the 2013–2018 reported data. Whenever possible, the eNHIS data are shown in the relevant EHA; for example, EHA 2 (Communicable Respiratory Diseases), EHA 3 (VBDs), and EHA 5 (WASH). COVID-19 data are presented in EHA 2 Communicable Respiratory Diseases.

Before the implementation of the eNHIS, health service providers were monitored by reviewing the data collected and reported by the Central Provincial Health Department and analysing the clinical encounter tally sheets at the functioning local clinics—Porebada Sub Health Centre, Boera Aid Post, and Papa Sub Health Centre. These clinics are administered and staffed by a variety of sponsors, including Papua New Guinea government (for example, Central Province [Porebada and Boera clinics]) and an NGO (Salvation Army) (Papa Sub Health Centre). The Boera Clinic has been permanently closed since January 2022.

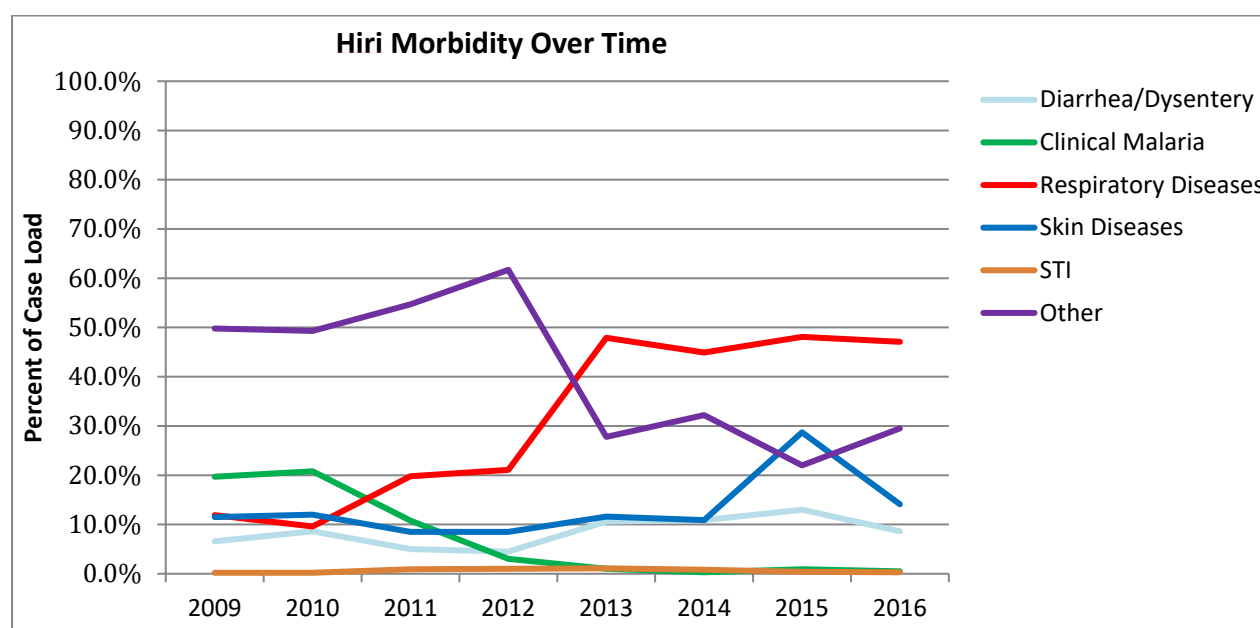
The household survey data are based on a standard set of questions used in demographic health surveys, including the recent 2016–2018 Papua New Guinea DHS.

### 6.3.2 Clinic-based morbidity data

Prior to the implementation of eNHIS, individual clinic data were accessed by reviewing and analysing monthly tally sheets. The new eNHIS system has simplified reporting and is aligned with the national SPAR reports. There are still diagnostic limitations related to the lack of individual clinic-based laboratory testing facilities and the diagnostic skill of the health care provider.

For example, pre-eNHIS data consistently demonstrate that “other” is typically the leading reported diagnosis across the Papua New Guinea outpatient clinics (see Figure 6-5). For the pre-eNHIS data, a clear and consistent definition of “other” was not available. As part of the PiHP, PNG IMR clinical resources were made available to the Papa Sub Health Centre over 2012–2016, which resulted in a marked improvement in diagnostic accuracy and consistency.

Additional significant impacts on the observed morbidity pattern included the introduction in 2010/11 of rapid diagnostic tests (RDTs) for malaria. RDTs have had a significant impact on the reported number of malaria cases—the number of RDT confirmed positive tests are very few compared to the number of “fever cases.” In the past (prior to 2010), “fever” was typically labelled and reported as “clinical malaria.” As will be discussed in the vector-borne disease EHA section, the number of RDT confirmed positive malaria cases in the LNG Plant villages is now extremely small, such that “confirmed malaria” does not appear to be a significant source of morbidity. A similar decline in malaria across the National Capital District (POM) has also been documented. RDT data are reported in eNHIS and are shown in EHA 3 VBDs.

**Figure 6-5. LNG Plant villages morbidity patterns 2009–2016**

The “clinical malaria” cases did not “disappear” but were typically “reclassified” as respiratory disease, particularly for children. Previous studies by PNG IMR on febrile illness have consistently confirmed that most fever cases in Papua New Guinea (for both adults and children) are respiratory related (PNG IMR 2013, 2015, 2016). Hence, a significant number of the “other” cases are likely infectious respiratory diseases.

The pre-COVID-19 general morbidity pattern across the LNG Plant villages is illustrated by the detailed analysis of 2016 morbidity data (see Table 6-7). The Boera Aid Post is a Central Province health facility, and the data were reported via the Porebada Sub Health Centre.

**Table 6-7. LNG Plant Village health facility morbidity data 2016**

|                      | Papa Sub Health Centre |            | Porebada Sub Health Centre |            | Total        |            |
|----------------------|------------------------|------------|----------------------------|------------|--------------|------------|
|                      | Number                 | %          | Number                     | %          | Number       | %          |
| Tuberculosis         | 27                     | 0.7        | 12                         | 0.5        | 39           | 0.6        |
| STIs                 | 16                     | 0.4        | 21                         | 0.8        | 37           | 0.6        |
| Skin infections      | 511                    | 14.0       | 340                        | 13.5       | 851          | 13.8       |
| Respiratory Diseases | 1,577                  | 43.1       | 1,217                      | 48.2       | 2,794        | 45.2       |
| Diarrhoea            | 484                    | 13.2       | 372                        | 14.7       | 856          | 13.8       |
| Malaria (clinical)   | 6                      | 0.2        | 0                          | 0          | 6            | 0.1        |
| Other (infections)   | 1,042                  | 28.5       | 561                        | 22.2       | 1,603        | 26.1       |
| <b>Total</b>         | <b>3,663</b>           | <b>100</b> | <b>2,523</b>               | <b>100</b> | <b>6,186</b> | <b>100</b> |

Source: PNG IMR 2016; 2017a

The available clinical data for 2017 for the Porebada, Boera, and Papa health facilities demonstrates the same morbidity pattern (see Table 6-8).

**Table 6-8. LNG Plant Village health facility morbidity data 2017**

|                      | Papa       |            | Porebada   |            | Boera      |            | Total        |            |
|----------------------|------------|------------|------------|------------|------------|------------|--------------|------------|
|                      | Number     | %          | Number     | %          | Number     | %          | Number       | %          |
| Tuberculosis         | 0          | 0.0        | 1          | 0.1        | 0          | 0.0        | 1            | 0.1        |
| STIs                 | 6          | 1.0        | 11         | 1.1        | 7          | 1.8        | 24           | 1.2        |
| Skin infections      | 68         | 10.8       | 185        | 19.2       | 57         | 15.0       | 310          | 15.7       |
| Respiratory Diseases | 317        | 50.4       | 323        | 33.5       | 88         | 23.1       | 728          | 36.9       |
| Diarrhoea            | 69         | 11.0       | 101        | 10.5       | 82         | 21.5       | 252          | 12.8       |
| Malaria (clinical)   | 5          | 0.8        | 17         | 1.8        | 0          | 0.0        | 22           | 1.1        |
| Other (infections)   | 164        | 26.1       | 327        | 33.9       | 147        | 38.6       | 638          | 32.3       |
| <b>Total</b>         | <b>629</b> | <b>100</b> | <b>965</b> | <b>100</b> | <b>381</b> | <b>100</b> | <b>1,975</b> | <b>100</b> |

Source: PNG IMR 2017a

As illustrated by Table 6-7 and Table 6-8, the overall burden of diseases is dominated by respiratory, skin, and diarrhoeal problems. Eye and ear diagnoses are also extremely common and typically the fourth highest in terms of frequency. Accidents and injuries are the fifth highest reported diagnostic category. This same general burden of disease pattern is also observed across all of Papua New Guinea, including the National Capital District (POM).

The 2018 and first quarter 2019 clinic data were collected and reviewed. There were substantial disruptions to clinic reporting, particularly for Porebada in 2018 and 2019. In addition, NewFields could not independently confirm if Boera Aid Post data were consistently transmitted (via Porebada) to the Central Province Health Management Information System (HMIS).

As reported by the Central Province HMIS, the 2018 combined Porebada and Papa sub health centres' burden of disease appears consistent with the 2016 and 2017 data:

- Respiratory infections: 50%
- Skin infections: 31%
- Eye and ear infections: 6%
- Diarrhoea: 6%
- Accidents and injuries: 2%
- All others: 5%

Cases of confirmed malaria, tuberculosis and STIs (including HIV/AIDS) are presented in the relevant EHA.

### Summary

- **LNG Plant Village burden of disease is stable over the pre-COVID-19 2016-2019 time period.**
- **In 2018, respiratory and skin, infections accounted for 81% of the reported outpatient illness diagnoses.**

### 6.3.3 Household survey morbidity data

Household survey morbidity questions were asked during the 2019 Hiri household survey related to whether anyone in the household had experienced an episode of fever, cough, or diarrhoea within the last 2 weeks. The “fever, cough, and diarrhoea” questions are commonly used on demographic health surveys including the 2016–18 Papua New Guinea DHS.

In the 2016–18 Papua New Guinea DHS, for each child under age 5, mothers were asked if the child had experienced a cough accompanied by short, rapid breathing or difficulty in breathing as a result of a chest-related problem (symptoms of acute respiratory infection [ARI]); a fever; or an episode of diarrhoea in the 2 weeks preceding the survey. Respondents were also asked if treatment was sought when the child was ill. Overall, 3% of children under age 5 showed symptoms of ARI, 18% had a fever, and 14% experienced diarrhoea in the 2 weeks preceding the survey. Morbidity household survey data are subjective because they are based on a mother’s perception of illnesses without validation by medical personnel.

For the 2019 Hiri household survey, responses by individual village and combined for all LNG Plant villages are shown in Table 6-9 to Table 6-11. The survey questions followed this sequence:

- Determination if there was utilisation of health services within 2 weeks preceding the survey.
- Determination of the reason for seeking health services, such as specific illness, health check-up, pregnancy related, other, and unspecified.
- Determination if key morbidity symptoms were present among household members—fever, cough, and/or diarrhoea.
- If health services were used, location of health service delivery and time required traveling for treatment and mode of transportation to the clinic.

As illustrated in Table 6-9 “reason services were sought”, “respiratory” is the leading named disease category. However, “Unspecified” dominates across all categories in a pattern consistent with the previously reported clinic data. The location of service provision (see Table 6-10) illustrates that with the exception of Porebada, villagers tend to access the clinic geographically aligned with their household. Less than 50% of Porebada respondents access the local clinic; in addition, substantial numbers (22%) of respondents use medical facilities in POM. These data are not surprising given the documented pattern of Porebada clinic closures. Both the mode of transport and the time required to access services data are consistent with longstanding field observations and discussions with community members—community members can generally access by walking and within a reasonable period of time.

Specific “cough, fever, and diarrhoea” survey data (including the associated location of service provision) are shown as reported in Table 6-12 through Table 6-17. As illustrated in Table 6-18, compared to the national DHS data, except for fever, the combined LNG Plant villages percentages were substantially below national DHS levels.

Table 6-9. Use of health services—reason services were sought within the 2 weeks preceding the survey (2019)

| Demographic       | Number of Individuals reported to have sought health services | Reason for which health services were sought |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
|-------------------|---------------------------------------------------------------|----------------------------------------------|-----------------|-------------------|-----------|--------------|------------------|-------------------|-----------|-------------------|-------------------|-----------|-----------------|--------------|
|                   |                                                               | Respiratory                                  | Health Check Up | Pregnancy Related | Malaria   | Skin Disease | Musculo-skeletal | Accident/Injuries | Fever     | Gastro-intestinal | Eye/Ear Infection | NCDs      | Other Specified | Un-specified |
| <b>Boera</b>      | <b>95</b>                                                     | <b>10%</b>                                   | <b>6%</b>       | <b>4%</b>         | <b>8%</b> | <b>1%</b>    | <b>3%</b>        | <b>2%</b>         | <b>--</b> | <b>6%</b>         | <b>1%</b>         | <b>--</b> | <b>1%</b>       | <b>56%</b>   |
| Adults (> 5 yrs)  |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 34                                                            | --                                           | 9%              | 9%                | 9%        | 3%           | 6%               | --                | --        | 6%                | 3%                | --        | --              | 55%          |
| Male              | 31                                                            | 13%                                          | 6%              | --                | 3%        | --           | 3%               | 6%                | --        | 13%               | --                | --        | --              | 55%          |
| Children (< 5yrs) |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 20                                                            | 25%                                          | --              | 5%                | 10%       | --           | --               | --                | --        | --                | --                | --        | --              | 60%          |
| Male              | 10                                                            | 10%                                          | 10%             | --                | 20%       | --           | --               | --                | --        | --                | --                | --        | 10%             | 50%          |
| <b>Lea Lea</b>    | <b>83</b>                                                     | <b>13%</b>                                   | <b>8%</b>       | <b>5%</b>         | <b>2%</b> | <b>2%</b>    | <b>1%</b>        | <b>1%</b>         | <b>2%</b> | <b>1%</b>         | <b>1%</b>         | <b>1%</b> | <b>1%</b>       | <b>60%</b>   |
| Adults (> 5 yrs)  |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 23                                                            | 4%                                           | 13%             | 13%               | --        | --           | --               | --                | --        | 4%                | --                | --        | --              | 65%          |
| Male              | 24                                                            | 8%                                           | 17%             | --                | --        | 4%           | 4%               | 4%                | 4%        | --                | 4%                | 4%        | 4%              | 46%          |
| Children (< 5yrs) |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 21                                                            | 24%                                          | --              | 5%                | 5%        | --           | --               | --                | --        | --                | --                | --        | --              | 67%          |
| Male              | 15                                                            | 20%                                          | --              | --                | 7%        | 7%           | --               | --                | 7%        | --                | --                | --        | --              | 60%          |
| <b>Papa</b>       | <b>60</b>                                                     | <b>8%</b>                                    | <b>7%</b>       | <b>15%</b>        | <b>2%</b> | <b>5%</b>    | <b>--</b>        | <b>5%</b>         | <b>3%</b> | <b>--</b>         | <b>3%</b>         | <b>3%</b> | <b>--</b>       | <b>48%</b>   |
| Adults (> 5 yrs)  |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 22                                                            | 9%                                           | 5%              | 18%               | 5%        | 5%           | --               | 5%                | 9%        | --                | 5%                | 9%        | --              | 32%          |
| Male              | 11                                                            | 9%                                           | 9%              | --                | --        | 9%           | --               | --                | --        | --                | --                | --        | --              | 73%          |
| Children (< 5yrs) |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 10                                                            | --                                           | --              | 30%               | --        | --           | --               | --                | --        | --                | --                | --        | --              | 70%          |
| Male              | 17                                                            | 12%                                          | 12%             | 12%               | --        | 6%           | --               | 12%               | --        | --                | 6%                | --        | --              | 41%          |
| <b>Porebada</b>   | <b>90</b>                                                     | <b>3%</b>                                    | <b>14%</b>      | <b>6%</b>         | <b>2%</b> | <b>7%</b>    | <b>6%</b>        | <b>2%</b>         | <b>4%</b> | <b>1%</b>         | <b>1%</b>         | <b>2%</b> | <b>2%</b>       | <b>49%</b>   |
| Adults (> 5 yrs)  |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 34                                                            | --                                           | 18%             | 9%                | --        | 6%           | 6%               | 3%                | 3%        | --                | --                | 3%        | 6%              | 47%          |
| Male              | 30                                                            | 7%                                           | 13%             | --                | 3%        | 7%           | 10%              | --                | 10%       | --                | 3%                | 3%        | --              | 43%          |
| Children (< 5yrs) |                                                               |                                              |                 |                   |           |              |                  |                   |           |                   |                   |           |                 |              |
| Female            | 8                                                             | 13%                                          | --              | --                | --        | 13%          | --               | 13%               | --        | --                | --                | --        | --              | 63%          |
| Male              | 18                                                            | --                                           | 17%             | 11%               | 6%        | 6%           | --               | --                | --        | 6%                | --                | --        | --              | 56%          |

Table 6-9. Use of health services—reason services were sought within the 2 weeks preceding the survey (2019)

| Demographic              | Number of<br>Individuals<br>reported to<br>have<br>sought<br>health<br>services | Reason for which health services were sought |                       |                      |           |                 |                      |                       |           |                       |                      |           |                    |                  |
|--------------------------|---------------------------------------------------------------------------------|----------------------------------------------|-----------------------|----------------------|-----------|-----------------|----------------------|-----------------------|-----------|-----------------------|----------------------|-----------|--------------------|------------------|
|                          |                                                                                 | Respiratory                                  | Health<br>Check<br>Up | Pregnancy<br>Related | Malaria   | Skin<br>Disease | Musculo-<br>skeletal | Accident/<br>Injuries | Fever     | Gastro-<br>intestinal | Eye/Ear<br>Infection | NCDs      | Other<br>Specified | Un-<br>specified |
| <b>Combined villages</b> | <b>328</b>                                                                      | <b>9%</b>                                    | <b>9%</b>             | <b>7%</b>            | <b>4%</b> | <b>4%</b>       | <b>3%</b>            | <b>2%</b>             | <b>2%</b> | <b>2%</b>             | <b>2%</b>            | <b>2%</b> | <b>1%</b>          | <b>54%</b>       |
| Adults (> 5 yrs)         |                                                                                 |                                              |                       |                      |           |                 |                      |                       |           |                       |                      |           |                    |                  |
| Female                   | 113                                                                             | 3%                                           | 12%                   | 12%                  | 4%        | 4%              | 4%                   | 2%                    | 3%        | 3%                    | 2%                   | 3%        | 2%                 | 50%              |
| Male                     | 96                                                                              | 9%                                           | 11%                   | --                   | 2%        | 4%              | 5%                   | 3%                    | 4%        | 4%                    | 2%                   | 2%        | 1%                 | 51%              |
| Children (≤ 5yrs)        |                                                                                 |                                              |                       |                      |           |                 |                      |                       |           |                       |                      |           |                    |                  |
| Female                   | 59                                                                              | 19%                                          | --                    | 8%                   | 5%        | 2%              | --                   | 2%                    | --        | --                    | --                   | --        | --                 | 64%              |
| Male                     | 60                                                                              | 10%                                          | 10%                   | 7%                   | 7%        | 5%              | --                   | 3%                    | 2%        | 2%                    | 2%                   | --        | 2%                 | 52%              |

Table 6-10. Use of health services—location of services (2019)

| Demographic       | Location for Treatment |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
|-------------------|------------------------|------------|-----------|-----------|--------------|------------------------|-----------|--------------|----------------------------|----------------|---------------------------------|-----------------------------|-------------|
|                   | Boera Aid Post         | Clinic POM | Home      | Hospital  | Hospital POM | Papa Sub health Centre | Pharmacy  | Pharmacy POM | Porebada Sub health Centre | Private doctor | Traditional practitioner/healer | Youth with a Mission (YWAM) | Unspecified |
| <b>Boera</b>      | <b>53%</b>             | --         | <b>2%</b> | <b>5%</b> | <b>9%</b>    | <b>13%</b>             | <b>1%</b> | <b>4%</b>    | --                         | --             | --                              | <b>1%</b>                   | <b>11%</b>  |
| Adults (> 5 yrs)  |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | 50%                    | --         | 3%        | 9%        | 9%           | 9%                     | --        | 3%           | --                         | --             | --                              | 3%                          | 15%         |
| Male              | 42%                    | --         | 3%        | 6%        | 10%          | 19%                    | --        | 3%           | --                         | --             | --                              | --                          | 16%         |
| Children (< 5yrs) |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | 65%                    | --         | --        | --        | 5%           | 10%                    | 5%        | 10%          | --                         | --             | --                              | --                          | 5%          |
| Male              | 70%                    | --         | --        | --        | 20%          | 10%                    | --        | --           | --                         | --             | --                              | --                          | --          |
| <b>Lea Lea</b>    | --                     | --         | <b>7%</b> | --        | <b>12%</b>   | <b>80%</b>             | --        | <b>1%</b>    | --                         | --             | --                              | --                          | --          |
| Adults (> 5 yrs)  |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | --                     | --         | 9%        | --        | 9%           | 83%                    | --        | --           | --                         | --             | --                              | --                          | --          |
| Male              | --                     | --         | 13%       | --        | 17%          | 67%                    | --        | 4%           | --                         | --             | --                              | --                          | --          |
| Children (< 5yrs) |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | --                     | --         | 5%        | --        | 10%          | 86%                    | --        | --           | --                         | --             | --                              | --                          | --          |
| Male              | --                     | --         | --        | --        | 13%          | 87%                    | --        | --           | --                         | --             | --                              | --                          | --          |
| <b>Papa</b>       | --                     | --         | --        | <b>2%</b> | <b>8%</b>    | <b>87%</b>             | --        | --           | --                         | <b>2%</b>      | <b>2%</b>                       | --                          | --          |
| Adults (> 5 yrs)  |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | --                     | --         | --        | 5%        | 9%           | 86%                    | --        | --           | --                         | --             | --                              | --                          | --          |
| Male              | --                     | --         | --        | --        | 9%           | 82%                    | --        | --           | --                         | --             | 9%                              | --                          | --          |
| Children (< 5yrs) |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | --                     | --         | --        | --        | --           | 100%                   | --        | --           | --                         | --             | --                              | --                          | --          |
| Male              | --                     | --         | --        | --        | 12%          | 82%                    | --        | --           | --                         | 6%             | --                              | --                          | --          |
| <b>Porebada</b>   | <b>2%</b>              | <b>3%</b>  | <b>6%</b> | <b>7%</b> | <b>22%</b>   | <b>8%</b>              | <b>1%</b> | <b>3%</b>    | <b>42%</b>                 | --             | --                              | <b>1%</b>                   | <b>4%</b>   |
| Adults (> 5 yrs)  |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | 3%                     | 6%         | 6%        | 9%        | 26%          | 9%                     | --        | 3%           | 38%                        | --             | --                              | --                          | --          |
| Male              | 3%                     | 3%         | 7%        | 10%       | 33%          | 10%                    | --        | 7%           | 17%                        | --             | --                              | 3%                          | 7%          |
| Children (< 5yrs) |                        |            |           |           |              |                        |           |              |                            |                |                                 |                             |             |
| Female            | --                     | --         | --        | --        | --           | 13%                    | --        | --           | 75%                        | --             | --                              | --                          | 13%         |
| Male              | --                     | --         | 6%        | --        | 6%           | --                     | 6%        | --           | 78%                        | --             | --                              | --                          | 6%          |

Table 6-10. Use of health services—location of services (2019)

| Demographic              | Location for Treatment |            |           |           |              |                        |           |              |                            |                 |                                 |                             |             |
|--------------------------|------------------------|------------|-----------|-----------|--------------|------------------------|-----------|--------------|----------------------------|-----------------|---------------------------------|-----------------------------|-------------|
|                          | Boera Aid Post         | Clinic POM | Home      | Hospital  | Hospital POM | Papa Sub health Centre | Pharmacy  | Pharmacy POM | Porebada Sub health Centre | Private doctor  | Traditional practitioner/healer | Youth with a Mission (YWAM) | Unspecified |
| <b>Combined villages</b> | <b>16%</b>             | <b>1%</b>  | <b>4%</b> | <b>4%</b> | <b>13%</b>   | <b>42%</b>             | <b>1%</b> | <b>2%</b>    | <b>12%</b>                 | <b>&lt;0.5%</b> | <b>&lt;0.5%</b>                 | <b>1%</b>                   | <b>5%</b>   |
| Adults (> 5 yrs)         |                        |            |           |           |              |                        |           |              |                            |                 |                                 |                             |             |
| Female                   | 16%                    | 2%         | 4%        | 6%        | 14%          | 39%                    | --        | 2%           | 12%                        | --              | --                              | 1%                          | 4%          |
| Male                     | 15%                    | 1%         | 6%        | 5%        | 19%          | 35%                    | --        | 4%           | 5%                         | --              | 1%                              | 1%                          | 7%          |
| Children (≤ 5yrs)        |                        |            |           |           |              |                        |           |              |                            |                 |                                 |                             |             |
| Female                   | 22%                    | --         | 2%        | --        | 5%           | 53%                    | 2%        | 3%           | 10%                        | --              | --                              | --                          | 3%          |
| Male                     | 12%                    | --         | 2%        | --        | 12%          | 47%                    | 2%        | --           | 23%                        | 2%              | --                              | --                          | 2%          |

Table 6-11. Use of health services (2019)

| Demographic              | Mode of transportation to get the treatment |      |         |         |             | Time it took to get to treatment |       |      |             |
|--------------------------|---------------------------------------------|------|---------|---------|-------------|----------------------------------|-------|------|-------------|
|                          | Ambulance                                   | Boat | On foot | Vehicle | Unspecified | Mins                             | Hours | Days | Unspecified |
| <b>Boera</b>             | --                                          | 1%   | 49%     | 33%     | 17%         | 70%                              | 13%   | 1%   | 17%         |
| Adults (> 5 yrs)         |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | 3%   | 47%     | 32%     | 18%         | 65%                              | 18%   | --   | 18%         |
| Male                     | --                                          | --   | 39%     | 39%     | 23%         | 65%                              | 13%   | --   | 23%         |
| Children (<= 5yrs)       |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 60%     | 30%     | 10%         | 80%                              | 5%    | 5%   | 10%         |
| Male                     | --                                          | --   | 60%     | 30%     | 10%         | 80%                              | 10%   | --   | 10%         |
| <b>Lea Lea</b>           | --                                          | --   | 36%     | 57%     | 7%          | 67%                              | 25%   | --   | 8%          |
| Adults (> 5 yrs)         |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 39%     | 52%     | 9%          | 70%                              | 17%   | --   | 13%         |
| Male                     | --                                          | --   | 33%     | 54%     | 13%         | 46%                              | 42%   | --   | 13%         |
| Children (<= 5yrs)       |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 38%     | 57%     | 5%          | 86%                              | 10%   | --   | 5%          |
| Male                     | --                                          | --   | 27%     | 73%     | --          | 67%                              | 33%   | --   | --          |
| <b>Papa</b>              | 2%                                          | --   | 73%     | 25%     | --          | 87%                              | 13%   | --   | --          |
| Adults (> 5 yrs)         |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | 5%                                          | --   | 68%     | 27%     | --          | 82%                              | 18%   | --   | --          |
| Male                     | --                                          | --   | 73%     | 27%     | --          | 100%                             | --    | --   | --          |
| Children (<= 5yrs)       |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 100%    | --      | --          | 100%                             | --    | --   | --          |
| Male                     | --                                          | --   | 65%     | 35%     | --          | 76%                              | 24%   | --   | --          |
| <b>Porebada</b>          | 4%                                          | 3%   | 39%     | 36%     | 18%         | 56%                              | 26%   | --   | 19%         |
| Adults (> 5 yrs)         |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | 6%                                          | 3%   | 35%     | 44%     | 12%         | 59%                              | 29%   | --   | 12%         |
| Male                     | 7%                                          | 7%   | 17%     | 50%     | 20%         | 40%                              | 40%   | --   | 20%         |
| Children (<= 5yrs)       |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 75%     | 13%     | 13%         | 75%                              | --    | --   | 25%         |
| Male                     | --                                          | --   | 67%     | 6%      | 28%         | 67%                              | 6%    | --   | 28%         |
| <b>Combined villages</b> | 2%                                          | 1%   | 47%     | 38%     | 12%         | 68%                              | 19%   | 0.3% | 12%         |
| Adults (> 5 yrs)         |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | 3%                                          | 2%   | 46%     | 39%     | 11%         | 67%                              | 21%   | --   | 12%         |
| Male                     | 2%                                          | 2%   | 34%     | 45%     | 17%         | 56%                              | 27%   | --   | 17%         |
| Children (<= 5yrs)       |                                             |      |         |         |             |                                  |       |      |             |
| Female                   | --                                          | --   | 61%     | 32%     | 7%          | 85%                              | 5%    | 2%   | 8%          |
| Male                     | --                                          | --   | 55%     | 35%     | 10%         | 72%                              | 18%   | --   | 10%         |

Table 6-12. Family health questions — cough (2019)

| Demographic              | Number of Individuals in the surveyed population (based on household totals) | Symptoms of Cough                                                             |                                             |                                                    |
|--------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------|
|                          |                                                                              | Percentage of surveyed population reporting the symptom in the last two weeks | Number of Individuals reporting the symptom | Percentage for whom advice or treatment was sought |
| <b>Boera</b>             | <b>694</b>                                                                   | <b>1%</b>                                                                     | <b>10</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 277                                                                          | 0%                                                                            | 0                                           | 0%                                                 |
| Male                     | 313                                                                          | 0%                                                                            | 1                                           | 10%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 53                                                                           | 11%                                                                           | 6                                           | 60%                                                |
| Male                     | 51                                                                           | 6%                                                                            | 3                                           | 30%                                                |
| <b>Lea Lea</b>           | <b>859</b>                                                                   | <b>2%</b>                                                                     | <b>21</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 336                                                                          | 1%                                                                            | 3                                           | 14%                                                |
| Male                     | 355                                                                          | 1%                                                                            | 4                                           | 19%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 73                                                                           | 8%                                                                            | 6                                           | 29%                                                |
| Male                     | 79                                                                           | 10%                                                                           | 8                                           | 38%                                                |
| <b>Papa</b>              | <b>585</b>                                                                   | <b>4%</b>                                                                     | <b>23</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 236                                                                          | 1%                                                                            | 3                                           | 13%                                                |
| Male                     | 259                                                                          | 2%                                                                            | 6                                           | 26%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 41                                                                           | 10%                                                                           | 4                                           | 17%                                                |
| Male                     | 49                                                                           | 20%                                                                           | 10                                          | 43%                                                |
| <b>Porebada</b>          | <b>1,360</b>                                                                 | <b>1%</b>                                                                     | <b>8</b>                                    |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 538                                                                          | 1%                                                                            | 3                                           | 38%                                                |
| Male                     | 613                                                                          | 0%                                                                            | 0                                           | 0%                                                 |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 107                                                                          | 3%                                                                            | 3                                           | 38%                                                |
| Male                     | 102                                                                          | 2%                                                                            | 2                                           | 25%                                                |
| <b>Combined villages</b> | <b>3,482</b>                                                                 | <b>2%</b>                                                                     | <b>62</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 1,387                                                                        | 1%                                                                            | 9                                           | 15%                                                |
| Male                     | 1,540                                                                        | 1%                                                                            | 11                                          | 18%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 274                                                                          | 7%                                                                            | 19                                          | 31%                                                |
| Male                     | 281                                                                          | 8%                                                                            | 23                                          | 37%                                                |

Table 6-13. Family health questions—cough, location of services (2019)

| Demographic       | Number of Individuals reporting the symptom | Location for treatment |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
|-------------------|---------------------------------------------|------------------------|----------------|--------|--------------------|----------------------|------------|------------|-----------------|------------------------|-----------------|--------------|----------------------------|-------|
|                   |                                             | Aid Post POM           | Boera Aid Post | Clinic | Four Square Clinic | Hiri District Clinic | Home       | Hospital   | Hospital POM    | Papa Sub health Centre | Pharmacy        | Pharmacy POM | Porebada Sub health Centre | Other |
| <b>Boera</b>      | <b>10</b>                                   | --                     | <b>60%</b>     | --     | --                 | --                   | --         | --         | <b>&lt;0.5%</b> | <b>20%</b>             | <b>&lt;0.5%</b> | --           | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 0                                           | --                     | --             | --     | --                 | --                   | --         | --         | --              | --                     | --              | --           | --                         | --    |
| Male              | 1                                           | --                     | 100%           | --     | --                 | --                   | --         | --         | --              | --                     | --              | --           | --                         | --    |
| Children (< 5yrs) |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 6                                           | --                     | 67%            | --     | --                 | --                   | --         | --         | <0.5%           | --                     | <0.5%           | --           | --                         | --    |
| Male              | 3                                           | --                     | 33%            | --     | --                 | --                   | --         | --         | --              | <0.5%                  | --              | --           | --                         | --    |
| <b>Lea Lea</b>    | <b>21</b>                                   | --                     | --             | --     | --                 | --                   | <b>33%</b> | <b>10%</b> | <b>5%</b>       | <b>52%</b>             | --              | --           | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 3                                           | --                     | --             | --     | --                 | --                   | 33%        | --         | --              | 67%                    | --              | --           | --                         | --    |
| Male              | 4                                           | --                     | --             | --     | --                 | --                   | 50%        | <0.5%      | --              | --                     | --              | --           | --                         | --    |
| Children (< 5yrs) |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 6                                           | --                     | --             | --     | --                 | --                   | 33%        | --         | --              | 67%                    | --              | --           | --                         | --    |
| Male              | 8                                           | --                     | --             | --     | --                 | --                   | 25%        | --         | <0.5%           | 63%                    | --              | --           | --                         | --    |
| <b>Papa</b>       | <b>23</b>                                   | --                     | --             | --     | --                 | --                   | <b>22%</b> | <b>13%</b> | --              | <b>65%</b>             | --              | --           | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 3                                           | --                     | --             | --     | --                 | --                   | 67%        | --         | --              | 33%                    | --              | --           | --                         | --    |
| Male              | 6                                           | --                     | --             | --     | --                 | --                   | 33%        | --         | --              | <0.5%                  | --              | --           | --                         | --    |
| Children (< 5yrs) |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 4                                           | --                     | --             | --     | --                 | --                   | --         | --         | --              | 100%                   | --              | --           | --                         | --    |
| Male              | 10                                          | --                     | --             | --     | --                 | --                   | <0.5%      | <0.5%      | --              | 60%                    | --              | --           | --                         | --    |
| <b>Porebada</b>   | <b>8</b>                                    | --                     | --             | --     | --                 | <b>&lt;0.5%</b>      | <b>13%</b> | --         | <b>13%</b>      | --                     | --              | --           | <b>63%</b>                 | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 3                                           | --                     | --             | --     | --                 | <0.5%                | 33%        | --         | --              | --                     | --              | --           | 33%                        | --    |
| Male              | 0                                           | --                     | --             | --     | --                 | --                   | --         | --         | --              | --                     | --              | --           | --                         | --    |
| Children (< 5yrs) |                                             |                        |                |        |                    |                      |            |            |                 |                        |                 |              |                            |       |
| Female            | 3                                           | --                     | --             | --     | --                 | --                   | --         | --         | <0.5%           | --                     | --              | --           | 67%                        | --    |
| Male              | 2                                           | --                     | --             | --     | --                 | --                   | --         | --         | --              | --                     | --              | --           | 100%                       | --    |

Table 6-13. Family health questions—cough, location of services (2019)

| Demographic              | Number of Individuals reporting the symptom | Location for treatment |                |        |                    |                      |      |          |              |                        |          |              |                            |       |
|--------------------------|---------------------------------------------|------------------------|----------------|--------|--------------------|----------------------|------|----------|--------------|------------------------|----------|--------------|----------------------------|-------|
|                          |                                             | Aid Post POM           | Boera Aid Post | Clinic | Four Square Clinic | Hiri District Clinic | Home | Hospital | Hospital POM | Papa Sub health Centre | Pharmacy | Pharmacy POM | Porebada Sub health Centre | Other |
| <b>Combined villages</b> | <b>62</b>                                   | --                     | 10%            | --     | --                 | 2%                   | 21%  | 8%       | 5%           | 45%                    | <0.5%    | --           | 8%                         | --    |
| Adults (> 5 yrs)         |                                             |                        |                |        |                    |                      |      |          |              |                        |          |              |                            |       |
| Female                   | 9                                           | --                     | --             | --     | --                 | <0.5%                | 44%  | --       | --           | 33%                    | --       | --           | 11%                        | --    |
| Male                     | 11                                          | --                     | 9%             | --     | --                 | --                   | 36%  | 18%      | --           | 36%                    | --       | --           | --                         | --    |
| Children (< 5yrs)        |                                             |                        |                |        |                    |                      |      |          |              |                        |          |              |                            |       |
| Female                   | 19                                          | --                     | 21%            | --     | --                 | --                   | 11%  | --       | <0.5%        | 42%                    | <0.5%    | --           | 11%                        | --    |
| Male                     | 23                                          | --                     | 4%             | --     | --                 | --                   | 13%  | 13%      | <0.5%        | 57%                    | --       | --           | 9%                         | --    |

Table 6-14. Family health questions—fever (2019)

| Demographic              | Number of Individuals in the surveyed population (based on household totals) | Symptoms of Fever                                                           |                                             |                                                    |
|--------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------|
|                          |                                                                              | Percentage of surveyed population reporting the symptom in the last 2 weeks | Number of Individuals reporting the symptom | Percentage for whom advice or treatment was sought |
| <b>Boera</b>             | <b>694</b>                                                                   | <b>2%</b>                                                                   | <b>17</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 277                                                                          | 3%                                                                          | 7                                           | 41%                                                |
| Male                     | 313                                                                          | 2%                                                                          | 5                                           | 29%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 53                                                                           | 6%                                                                          | 3                                           | 18%                                                |
| Male                     | 51                                                                           | 4%                                                                          | 2                                           | 12%                                                |
| <b>Lea Lea</b>           | <b>843</b>                                                                   | <b>3%</b>                                                                   | <b>29</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 336                                                                          | 2%                                                                          | 7                                           | 24%                                                |
| Male                     | 355                                                                          | 1%                                                                          | 5                                           | 17%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 73                                                                           | 12%                                                                         | 9                                           | 31%                                                |
| Male                     | 79                                                                           | 10%                                                                         | 8                                           | 28%                                                |
| <b>Papa</b>              | <b>585</b>                                                                   | <b>2%</b>                                                                   | <b>11</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 236                                                                          | 2%                                                                          | 5                                           | 45%                                                |
| Male                     | 259                                                                          | 1%                                                                          | 2                                           | 18%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 41                                                                           | 7%                                                                          | 3                                           | 27%                                                |
| Male                     | 49                                                                           | 2%                                                                          | 1                                           | 9%                                                 |
| <b>Porebada</b>          | <b>1,360</b>                                                                 | <b>3%</b>                                                                   | <b>37</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 538                                                                          | 2%                                                                          | 11                                          | 30%                                                |
| Male                     | 613                                                                          | 2%                                                                          | 14                                          | 38%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 107                                                                          | 5%                                                                          | 5                                           | 14%                                                |
| Male                     | 102                                                                          | 7%                                                                          | 7                                           | 19%                                                |
| <b>Combined villages</b> | <b>3,482</b>                                                                 | <b>3%</b>                                                                   | <b>94</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 1,387                                                                        | 2%                                                                          | 30                                          | 32%                                                |
| Male                     | 1,540                                                                        | 2%                                                                          | 26                                          | 28%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                             |                                             |                                                    |
| Female                   | 274                                                                          | 7%                                                                          | 20                                          | 21%                                                |
| Male                     | 281                                                                          | 6%                                                                          | 18                                          | 19%                                                |

Table 6-15. Family health questions—fever, location of services (2019)

| Demographic       | Number of Individuals reporting the symptom | Location for Treatment |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
|-------------------|---------------------------------------------|------------------------|----------------|-----------|--------------------|----------------------|------------|------------|--------------|--------------------|----------|--------------|-------------------|-----------|
|                   |                                             | Aid Post POM           | Boera Aid Post | Clinic    | Four Square Clinic | Hiri District Clinic | Home       | Hospital   | Hospital POM | Papa Health Centre | Pharmacy | Pharmacy POM | Porebada Aid Post | Other     |
| <b>Boera</b>      | <b>17</b>                                   | --                     | <b>65%</b>     | <b>6%</b> | --                 | <b>6%</b>            | <b>12%</b> | --         | --           | <b>12%</b>         | --       | --           | --                | --        |
| Adults (> 5 yrs)  |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 7                                           | --                     | 57%            | 14%       | --                 | --                   | 14%        | --         | --           | 14%                | --       | --           | --                | --        |
| Male              | 5                                           | --                     | 60%            | --        | --                 | 20%                  | 20%        | --         | --           | --                 | --       | --           | --                | --        |
| Children (≤ 5yrs) |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 3                                           | --                     | 67%            | --        | --                 | --                   | --         | --         | --           | 33%                | --       | --           | --                | --        |
| Male              | 2                                           | --                     | 100%           | --        | --                 | --                   | --         | --         | --           | --                 | --       | --           | --                | --        |
| <b>Lea Lea</b>    | <b>29</b>                                   | --                     | --             | --        | --                 | --                   | <b>21%</b> | <b>14%</b> | <b>3%</b>    | <b>59%</b>         | --       | <b>3%</b>    | --                | --        |
| Adults (> 5 yrs)  |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 7                                           | --                     | --             | --        | --                 | --                   | 14%        | 14%        | 14%          | 57%                | --       | --           | --                | --        |
| Male              | 5                                           | --                     | --             | --        | --                 | --                   | 40%        | --         | --           | 60%                | --       | --           | --                | --        |
| Children (≤ 5yrs) |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 9                                           | --                     | --             | --        | --                 | --                   | 22%        | 22%        | --           | 44%                | --       | 11%          | --                | --        |
| Male              | 8                                           | --                     | --             | --        | --                 | --                   | 13%        | 13%        | --           | 75%                | --       | --           | --                | --        |
| <b>Papa</b>       | <b>11</b>                                   | --                     | --             | --        | --                 | --                   | <b>18%</b> | <b>9%</b>  | --           | <b>73%</b>         | --       | --           | --                | --        |
| Adults (> 5 yrs)  |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 5                                           | --                     | --             | --        | --                 | --                   | 20%        | --         | --           | 80%                | --       | --           | --                | --        |
| Male              | 2                                           | --                     | --             | --        | --                 | --                   | 50%        | 50%        | --           | --                 | --       | --           | --                | --        |
| Children (≤ 5yrs) |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 3                                           | --                     | --             | --        | --                 | --                   | --         | --         | --           | 100%               | --       | --           | --                | --        |
| Male              | 1                                           | --                     | --             | --        | --                 | --                   | --         | --         | --           | 100%               | --       | --           | --                | --        |
| <b>Porebada</b>   | <b>37</b>                                   | <b>3%</b>              | <b>3%</b>      | --        | <b>3%</b>          | --                   | <b>8%</b>  | <b>14%</b> | <b>8%</b>    | <b>5%</b>          | --       | <b>3%</b>    | <b>49%</b>        | <b>5%</b> |
| Adults (> 5 yrs)  |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 11                                          | --                     | --             | --        | --                 | --                   | 9%         | --         | 9%           | 9%                 | --       | 9%           | 55%               | 9%        |
| Male              | 14                                          | 7%                     | 7%             | --        | 7%                 | --                   | 7%         | 29%        | 14%          | 7%                 | --       | --           | 14%               | 7%        |
| Children (≤ 5yrs) |                                             |                        |                |           |                    |                      |            |            |              |                    |          |              |                   |           |
| Female            | 5                                           | --                     | --             | --        | --                 | --                   | 20%        | 20%        | --           | --                 | --       | --           | 60%               | --        |
| Male              | 7                                           | --                     | --             | --        | --                 | --                   | --         | --         | --           | --                 | --       | --           | 100%              | --        |

Table 6-15. Family health questions—fever, location of services (2019)

| Demographic              | Number of Individuals reporting the symptom | Location for Treatment |                |           |                    |                      |            |            |              |                    |           |              |                   |           |
|--------------------------|---------------------------------------------|------------------------|----------------|-----------|--------------------|----------------------|------------|------------|--------------|--------------------|-----------|--------------|-------------------|-----------|
|                          |                                             | Aid Post POM           | Boera Aid Post | Clinic    | Four Square Clinic | Hiri District Clinic | Home       | Hospital   | Hospital POM | Papa Health Centre | Pharmacy  | Pharmacy POM | Porebada Aid Post | Other     |
| <b>Combined villages</b> | <b>94</b>                                   | <b>1%</b>              | <b>13%</b>     | <b>1%</b> | <b>1%</b>          | <b>1%</b>            | <b>14%</b> | <b>11%</b> | <b>4%</b>    | <b>31%</b>         | <b>--</b> | <b>2%</b>    | <b>19%</b>        | <b>2%</b> |
| Adults (> 5 yrs)         |                                             |                        |                |           |                    |                      |            |            |              |                    |           |              |                   |           |
| Female                   | 30                                          | --                     | 13%            | 3%        | --                 | --                   | 13%        | 3%         | 7%           | 33%                | --        | 3%           | 20%               | 3%        |
| Male                     | 26                                          | 4%                     | 15%            | --        | 4%                 | 4%                   | 19%        | 19%        | 8%           | 15%                | --        | --           | 8%                | 4%        |
| Children (≤ 5yrs)        |                                             |                        |                |           |                    |                      |            |            |              |                    |           |              |                   |           |
| Female                   | 20                                          | --                     | 10%            | --        | --                 | --                   | 15%        | 15%        | --           | 40%                | --        | 5%           | 15%               | --        |
| Male                     | 18                                          | --                     | 11%            | --        | --                 | --                   | 6%         | 6%         | --           | 39%                | --        | --           | 39%               | --        |

Table 6-16. Family health questions—diarrhoea (2019)

| Demographic              | Number of Individuals in the surveyed population (based on household totals) | Symptoms of Diarrhoea                                                         |                                             |                                                    |
|--------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------|
|                          |                                                                              | Percentage of surveyed population reporting the symptom in the last two weeks | Number of Individuals reporting the symptom | Percentage for whom advice or treatment was sought |
| <b>Boera</b>             | <b>694</b>                                                                   | <b>1%</b>                                                                     | <b>5</b>                                    |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 277                                                                          | 0%                                                                            | 1                                           | 20%                                                |
| Male                     | 313                                                                          | 1%                                                                            | 4                                           | 80%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 53                                                                           | 0%                                                                            | 0                                           | 0%                                                 |
| Male                     | 51                                                                           | 0%                                                                            | 0                                           | 0%                                                 |
| <b>Lea Lea</b>           | <b>843</b>                                                                   | <b>0%</b>                                                                     | <b>2</b>                                    |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 336                                                                          | 0%                                                                            | 1                                           | 50%                                                |
| Male                     | 355                                                                          | 0%                                                                            | 0                                           | 0%                                                 |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 73                                                                           | 1%                                                                            | 1                                           | 50%                                                |
| Male                     | 79                                                                           | 0%                                                                            | 0                                           | 0%                                                 |
| <b>Papa</b>              | <b>585</b>                                                                   | <b>0%</b>                                                                     | <b>2</b>                                    |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 236                                                                          | 0%                                                                            | 1                                           | 50%                                                |
| Male                     | 259                                                                          | 0%                                                                            | 1                                           | 50%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 41                                                                           | 0%                                                                            | 0                                           | 0%                                                 |
| Male                     | 49                                                                           | 0%                                                                            | 0                                           | 0%                                                 |
| <b>Porebada</b>          | <b>1,360</b>                                                                 | <b>0%</b>                                                                     | <b>6</b>                                    |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 538                                                                          | 0%                                                                            | 0                                           | 0%                                                 |
| Male                     | 613                                                                          | 0%                                                                            | 1                                           | 17%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 107                                                                          | 2%                                                                            | 2                                           | 33%                                                |
| Male                     | 102                                                                          | 3%                                                                            | 3                                           | 50%                                                |
| <b>Combined villages</b> | <b>3,482</b>                                                                 | <b>0%</b>                                                                     | <b>15</b>                                   |                                                    |
| Adults (> 5 yrs)         |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 1,387                                                                        | 0%                                                                            | 3                                           | 20%                                                |
| Male                     | 1,540                                                                        | 0%                                                                            | 6                                           | 40%                                                |
| Children (≤ 5yrs)        |                                                                              |                                                                               |                                             |                                                    |
| Female                   | 274                                                                          | 1%                                                                            | 3                                           | 20%                                                |
| Male                     | 281                                                                          | 1%                                                                            | 3                                           | 20%                                                |

Table 6-17. Family health questions—diarrhoea, location of services (2019)

| Demographic       | Number of Individuals reporting the symptom | Location for Treatment |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
|-------------------|---------------------------------------------|------------------------|----------------|--------|--------------------|----------------------|------------|----------|--------------|------------------------|----------|--------------|----------------------------|-------|
|                   |                                             | Aid Post POM           | Boera Aid Post | Clinic | Four Square Clinic | Hiri District Clinic | Home       | Hospital | Hospital POM | Papa Sub health Centre | Pharmacy | Pharmacy POM | Porebada Sub health Centre | Other |
| <b>Boera</b>      | <b>5</b>                                    | --                     | <b>60%</b>     | --     | --                 | --                   | <b>20%</b> | --       | --           | --                     | --       | <b>20%</b>   | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 1                                           | --                     | 100%           | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| Male              | 4                                           | --                     | 50%            | --     | --                 | --                   | 25%        | --       | --           | --                     | --       | 25%          | --                         | --    |
| Children (≤ 5yrs) |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| Male              | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| <b>Lea Lea</b>    | <b>2</b>                                    | --                     | --             | --     | --                 | --                   | --         | --       | --           | <b>100%</b>            | --       | --           | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 1                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | 100%                   | --       | --           | --                         | --    |
| Male              | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| Children (≤ 5yrs) |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 1                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | 100%                   | --       | --           | --                         | --    |
| Male              | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| <b>Papa</b>       | <b>2</b>                                    | --                     | --             | --     | --                 | --                   | --         | --       | --           | <b>100%</b>            | --       | --           | --                         | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 1                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | 100%                   | --       | --           | --                         | --    |
| Male              | 1                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | 100%                   | --       | --           | --                         | --    |
| Children (≤ 5yrs) |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| Male              | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| <b>Porebada</b>   | <b>6</b>                                    | --                     | --             | --     | --                 | --                   | <b>17%</b> | --       | --           | --                     | --       | --           | <b>83%</b>                 | --    |
| Adults (> 5 yrs)  |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 0                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | --                         | --    |
| Male              | 1                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | 100%                       | --    |
| Children (≤ 5yrs) |                                             |                        |                |        |                    |                      |            |          |              |                        |          |              |                            |       |
| Female            | 2                                           | --                     | --             | --     | --                 | --                   | --         | --       | --           | --                     | --       | --           | 100%                       | --    |
| Male              | 3                                           | --                     | --             | --     | --                 | --                   | 33%        | --       | --           | --                     | --       | --           | 67%                        | --    |

Table 6-17. Family health questions—diarrhoea, location of services (2019)

| Demographic              | Number of<br>Individuals<br>reporting<br>the<br>symptom | Location for Treatment |                      |        |                          |                            |            |          |                 |                                 |          |                 |                                     |       |
|--------------------------|---------------------------------------------------------|------------------------|----------------------|--------|--------------------------|----------------------------|------------|----------|-----------------|---------------------------------|----------|-----------------|-------------------------------------|-------|
|                          |                                                         | Aid<br>Post<br>POM     | Boera<br>Aid<br>Post | Clinic | Four<br>Square<br>Clinic | Hiri<br>District<br>Clinic | Home       | Hospital | Hospital<br>POM | Papa<br>Sub<br>health<br>Centre | Pharmacy | Pharmacy<br>POM | Porebada<br>Sub<br>health<br>Centre | Other |
| <b>Combined villages</b> | <b>15</b>                                               | --                     | <b>20%</b>           | --     | --                       | --                         | <b>13%</b> | --       | --              | <b>27%</b>                      | --       | <b>7%</b>       | <b>33%</b>                          | --    |
| Adults (> 5 yrs)         |                                                         |                        |                      |        |                          |                            |            |          |                 |                                 |          |                 |                                     |       |
| Female                   | 3                                                       | --                     | 33%                  | --     | --                       | --                         | --         | --       | --              | 67%                             | --       | --              | --                                  | --    |
| Male                     | 6                                                       | --                     | 33%                  | --     | --                       | --                         | 17%        | --       | --              | 17%                             | --       | 17%             | 17%                                 | --    |
| Children (≤ 5yrs)        |                                                         |                        |                      |        |                          |                            |            |          |                 |                                 |          |                 |                                     |       |
| Female                   | 3                                                       | --                     | --                   | --     | --                       | --                         | --         | --       | --              | 33%                             | --       | --              | 67%                                 | --    |
| Male                     | 3                                                       | --                     | --                   | --     | --                       | --                         | 33%        | --       | --              | --                              | --       | --              | 67%                                 | --    |

**Table 6-18. Fever, cough, and diarrhoea comparison—LNG Plant villages (2019) versus 2018 demographic health survey**

| Symptom   | Combined LNG Plant villages (% reporting symptom) | 2018 DHS (% reporting symptom) |
|-----------|---------------------------------------------------|--------------------------------|
| Cough     | 2%                                                | 3%                             |
| Fever     | 3%                                                | 18%                            |
| Diarrhoea | <1%                                               | 14%                            |

Sources: Tetra Tech Coffey 2019 survey; DHS 2018

The household level self-reported pre-COVID-19 morbidity data indicates that the LNG Plant villages appear to have a lower burden of disease versus national Papua New Guinea. As discussed in both the LNG Plant Social Baseline and in subsequent sections of the Community Health Baseline Report, the LNG Plant villages have a generally higher socio-economic and educational attainment status compared to rural Papua New Guinea.

#### Key Observations

- **Pre-COVID-19 LNG Plant Village household survey morbidity data (2019) are consistent with the available Porebada Sub Health Centre, Papa Sub Health Centre, and Boera health clinic reports.**
- **The pre-COVID-19 reported burden of “cough, fever, and diarrhoea” appears to be lower in the LNG Plant villages (<6%) versus national Papua New Guinea data (35%).**

### 6.3.4 Mortality data

This section discusses both adult and child mortality data. Overall national cause of death data are presented based on a 2019 paper by Kitur et al. As noted by Kitur (2019), “little is known about the distribution of CODs in PNG because the civil registration system does not accurately record death data; reported deaths from health facilities [hospital-based] comprise only a small proportion of deaths and there is limited data on the causes of non-hospital deaths.” Provincial level 2011 cause specific mortality fractions (CSMF) were developed by Kitur et al. (2019) and are shown for Papua New Guinea, National Capital District, and the Central Province (see Table 6-19). CSMF is the number of deaths from a specific cause divided by all deaths.

Infectious diseases include malaria, pneumonia, diarrhoea, tuberculosis, HIV, and cervical cancer<sup>5</sup>. NCDs include chronic respiratory diseases, cancer, renal failure, liver cirrhosis, diabetes, stroke, heart disease and lung cancer. Injuries include homicide, falls, road traffic accidents, bites of venomous animals, fires, poisoning and suicide.

<sup>5</sup> Cervical cancer is caused by the Human Papilloma Virus (HPV)

**Table 6-19. 2011 Estimated cause-specific mortality fraction (CSMF)**

|                           | Infectious Diseases | NCDs | Injuries |
|---------------------------|---------------------|------|----------|
| Central                   | 37%                 | 46%  | 17%      |
| National Capital District | 38%                 | 53%  | 9%       |
| National                  | 44%                 | 44%  | 11%      |

Source: Kitur et al. 2019

**Adult mortality data**

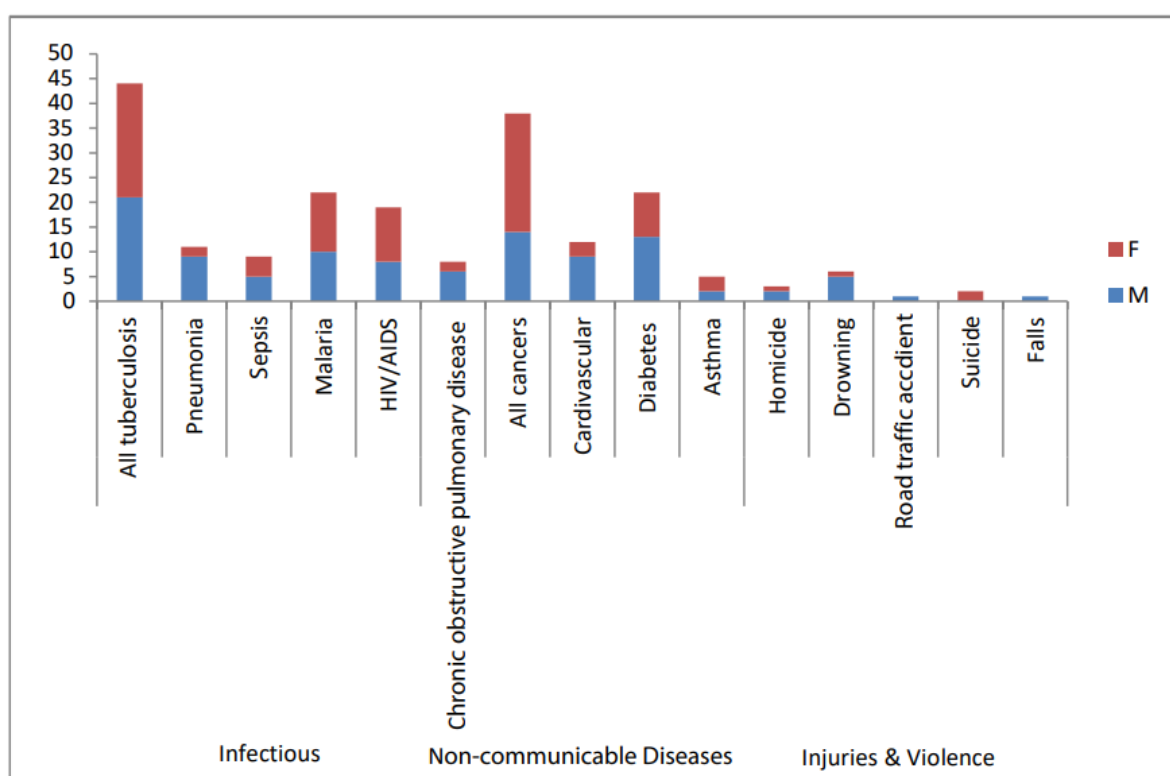
Pre-COVID-19 mortality data were inconsistently (if at all) reported through the Central Province HMIS. Review of the January–December 2018 Porebada and Papa sub health centres' tally sheets found no reported death cases for any cause. The eNHIS does not systematically collect and report cause of death data.

As part of the PiHP, Papua New PNG IMR developed mortality data by performing “verbal autopsies” (VA). VA is a proven method of obtaining data about cause of death at a population level. PNG IMR uses the Population Health Metrics Research Consortium VA instrument to follow up on deaths in Hiri. Over the 2010–2016 time period, PNG IMR performed 305 VAs in Hiri. The top three causes of adult death in Hiri were:

1. All tuberculosis
2. All cancers
3. Diabetes/malaria

Figure 6-6 shows the probable cause of adult death for Hiri in 2015. The y-axis shows absolute number of cases. As of November 2022, the PNG IMR 2015 study represents the most currently available adult COD data. While published in 2019, the Kitur et al. report estimated CSMF are for 2011. According to PNG IMR (2015), most deaths in Hiri are also infectious in nature but NCDs like cardiovascular diseases and cancers are a very close second.

Figure 6-6. Probable cause of adult death—Hiri (2015)



Source: PNG IMR 2015

### Childhood mortality data

National Papua New Guinea early childhood mortality rates are available from the 2016–19 DHS. Table 6-20 presents these data.

Table 6-20. Papua New Guinea national early childhood mortality rates

| Years preceding the survey* | Neonatal mortality | Post neonatal mortality | Infant mortality | Child mortality | Under-5 mortality |
|-----------------------------|--------------------|-------------------------|------------------|-----------------|-------------------|
| 0-4                         | 20                 | 13                      | 33               | 16              | 49                |
| 5-9                         | 27                 | 15                      | 42               | 13              | 55                |
| 10-14                       | 26                 | 16                      | 42               | 18              | 59                |

Source: NSO and ICF 2019

\*5-year periods preceding the PNG DHS 2016-18 survey

The five DHS mortality rates are:

1. **Neonatal mortality:** the probability of dying within the first month of life
2. **Post neonatal mortality:** the difference between infant and neonatal mortality
3. **Infant mortality:** the probability of dying before the first birthday
4. **Child mortality:** the probability of dying between the first and the fifth birthday
5. **Under-5 mortality:** the probability of dying between birth and the fifth birthday

All rates are expressed per 1,000 live births except for child mortality, which is expressed per 1,000 children surviving to age 12 months.

PNG IMR reported childhood mortality rates for Hiri in 2015 and 2016. These data are shown in Table 6-21; however, they should be cautiously interpreted due to small number of observations, which affects the stability of the calculated rates.

**Table 6-21. Child mortality rate estimation—Hiri 2015 and 2016**

|                                                    | 2015 | 2016  |
|----------------------------------------------------|------|-------|
| Total number of live births                        | 312  | 291   |
| Total deaths U5                                    | 7    | 16    |
| Children U5 mortality rate (per 1,000 live births) | 22.4 | 54.98 |
| Total infant deaths                                | 1    | 6     |
| Infant mortality rate (per 1,000 live births)      | 3.21 | 20.62 |
| Total neonatal deaths                              | 1    | 8     |
| Neonatal mortality rate (per 1,000 live births)    | 3.21 | 27.49 |

Source: PNG IMR 2018

The 2016 PNG IMR childhood mortality data are generally consistent with the overall DHS 2016–18 Papua New Guinea national childhood mortality.

#### Key Observations

- According to PNG IMR (2015), most deaths in Hiri are also infectious in nature but NCDs like cardiovascular diseases and cancers are a very close second.
- LNG Plant Village childhood mortality data are consistent with the 2016–18 Papua New Guinea DHS rates.

## 6.4 Stakeholder/key informant interviews

This section discusses stakeholder engagement and KIIs.

### 6.4.1 Stakeholder engagement

Health discussions occurred with small groups of village residents per LNG Plant Village. The health team interviewed women and men separately. Open-ended questions were posed to determine the top concerns related to health. Key social determinants of health (SDH) issues, such as income, employment, and educational opportunities, were raised by respondents. In addition, some respondents also discussed the potential for in-migration associated with a future LNG construction phase.

Table 6-22. Key findings from stakeholder engagement

| Health (EHAs)                                                                                                                                                                                                                                            | Porebada |      | Boera  |      | Papa   |      | Lea Lea |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|--------|------|--------|------|---------|------|
|                                                                                                                                                                                                                                                          | Female   | Male | Female | Male | Female | Male | Female  | Male |
| <b>Health systems infrastructure, services</b>                                                                                                                                                                                                           |          |      |        |      |        |      |         |      |
| Not enough health staff for increased demand                                                                                                                                                                                                             | X        |      | X      |      | X      |      | X       |      |
| CHW often not available; health centre often closed                                                                                                                                                                                                      | X        | X    |        |      |        |      |         | X    |
| No health care available in the village, other than a few birth attendants; most go to Papa Clinic for ANC visits, immunizations, deliveries, etc.; a building was constructed by a “member” a few years ago but was never completed; there are no staff |          |      |        |      |        |      | X       | X    |
| Women delivering at home and new-borns at home without treatment when needed; the only training attended by the village level birth attendants was in 2007                                                                                               | X        |      |        |      |        |      |         |      |
| No transportation when needed for deliveries with complications                                                                                                                                                                                          | X        |      | X      |      | X      |      | X       |      |
| Women are charged 20 Kina (US\$5.89) for deliveries at Papa, compared to 100 Kina (US\$29.45) at Boera and Porebada. Often it's too expensive in Boera.                                                                                                  | X        |      | X      |      | X      |      | X       |      |
| Lack of first aid training                                                                                                                                                                                                                               | X        |      |        |      |        |      |         |      |
| Insufficient medications and supplies                                                                                                                                                                                                                    | X        | X    | X      |      | X      |      | X       |      |
| No refrigerator; therefore, cannot administer immunizations; no transportation, no radio or cell phone for communication.                                                                                                                                |          |      | X      |      |        |      |         |      |
| <b>Respiratory</b>                                                                                                                                                                                                                                       |          |      |        |      |        |      |         |      |

Table 6-22. Key findings from stakeholder engagement

| Health (EHAs)                                                                                                                                          | Porebada |      | Boera  |      | Papa   |      | Lea Lea |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|--------|------|--------|------|---------|------|
|                                                                                                                                                        | Female   | Male | Female | Male | Female | Male | Female  | Male |
| Tuberculosis, including MDR; “some have swollen stomachs, skin colour turns black, some have died”; “some have tuberculosis in the stomach and bone    | X        | X    | X      | X    | X      | X    | X       | X    |
| Leprosy                                                                                                                                                |          |      |        |      |        |      | X       |      |
| <b>Vector Related</b>                                                                                                                                  |          |      |        |      |        |      |         |      |
| No comments                                                                                                                                            |          |      |        |      |        |      |         |      |
| <b>STIs</b>                                                                                                                                            |          |      |        |      |        |      |         |      |
| It’s common for single mothers to sell sex for money; there are no outside sex workers                                                                 | X        |      |        | X    | X      | X    | X       | X    |
| AIDS is a concern                                                                                                                                      |          |      | X      |      |        |      |         |      |
| <b>WASH related</b>                                                                                                                                    |          |      |        |      |        |      |         |      |
| Personal hygiene, especially with women who ignore hygiene after delivery which results in infections                                                  | X        | X    |        | X    |        | X    |         | X    |
| Poor community sanitation and hygiene; children playing in unsanitary conditions                                                                       | X        | X    |        |      |        |      | X       |      |
| Domestic animals roaming the village                                                                                                                   | X        |      |        |      |        |      |         |      |
| “Fish eat the waste, we catch the fish and eat the fish containing the waste”                                                                          |          | X    |        |      |        |      | X       |      |
| Access to clean water for drinking                                                                                                                     | X        | X    | X      | X    | X      | X    | X       | X    |
| <b>Food nutrition related, including food security</b>                                                                                                 |          |      |        |      |        |      |         |      |
| Nutrition; the same food is consumed every day (rice and tin fish) with no garden vegetables                                                           | X        |      |        |      |        |      |         |      |
| <b>NCDs</b>                                                                                                                                            |          |      |        |      |        |      |         |      |
| Cervical cancer, no treatment available in POM, except from private hospitals that are expensive, must travel to Lae, reportedly Susu Mamas can assist | X        |      | X      |      | X      |      | X       |      |

Table 6-22. Key findings from stakeholder engagement

| Health (EHAs)                                                                                                                                                                                                              | Porebada |      | Boera  |      | Papa   |      | Lea Lea |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|--------|------|--------|------|---------|------|
|                                                                                                                                                                                                                            | Female   | Male | Female | Male | Female | Male | Female  | Male |
| Diabetes and hypertension is on the rise (among men and women); hypertension is also a problem with pregnant women, stroke is occurring                                                                                    |          | X    | X      | X    | X      | X    | X       | X    |
| <b>Accidents and Injuries</b>                                                                                                                                                                                              |          |      |        |      |        |      |         |      |
| Snake Bite                                                                                                                                                                                                                 |          |      | X      |      | X      |      |         |      |
| <b>Exposure to Potentially Hazardous Materials</b>                                                                                                                                                                         |          |      |        |      |        |      |         |      |
| No comments                                                                                                                                                                                                                |          |      |        |      |        |      |         |      |
| <b>SDHs</b>                                                                                                                                                                                                                |          |      |        |      |        |      |         |      |
| Marital communication; the group stated that the Tokout Tokstret program conducted by PSI several years ago was effective and should be continued                                                                          | X        |      |        |      |        |      |         |      |
| Teens and alcohol; homemade versions are very cheap and accessible                                                                                                                                                         | X        | X    |        | X    |        | X    | X       | X    |
| Very young children, as young as 10 years are mixing lime powder (used with betel nut) with cigarette ash and either putting it in the mouth (sublingual) or inhaling it, causing major behaviour issues (“they go crazy”) | X        |      |        |      |        |      | X       |      |
| Teen pregnancy, at early ages                                                                                                                                                                                              | X        |      | X      |      |        |      | X       |      |
| Stomach aches after birth                                                                                                                                                                                                  |          |      | X      |      |        |      | X       |      |
| Drug abuse                                                                                                                                                                                                                 |          |      |        |      |        |      | X       |      |
| Alcohol abuse with homemade brew, can easily make with yeast and sugar and generate income; pregnant women abuse alcohol which results in deformed babies; young children abuse alcohol                                    |          | X    |        | X    |        | X    | X       | X    |
| <b>Veterinary medicine and zoonotic diseases</b>                                                                                                                                                                           |          |      |        |      |        |      |         |      |

**Table 6-22. Key findings from stakeholder engagement**

| Health (EHAs)                          | Porebada |      | Boera  |      | Papa   |      | Lea Lea |      |
|----------------------------------------|----------|------|--------|------|--------|------|---------|------|
|                                        | Female   | Male | Female | Male | Female | Male | Female  | Male |
| No comments                            |          |      |        |      |        |      |         |      |
| <b>Cultural health practices</b>       |          |      |        |      |        |      |         |      |
| No comments                            |          |      |        |      |        |      |         |      |
| <b>Social</b>                          |          |      |        |      |        |      |         |      |
| <b>Income Generation Opportunities</b> |          | X    |        | X    |        | X    |         | X    |
| <b>Employment by Project/LANCO</b>     |          | X    |        | X    |        | X    |         | X    |
| <b>Education Opportunities</b>         |          |      |        | X    |        |      |         |      |
| <b>Women need more education</b>       | X        |      | X      |      | X      |      | X       |      |
| <b>In-Migration</b>                    |          |      |        |      |        |      |         |      |
| In-migration is not an issue           | X        | X    | X      | X    | X      | X    | X       | X    |

#### 6.4.2 Stakeholder engagement key findings

There is a general consistency across all the KIIs regardless of whether it was a male or female focus groups. The following key observations were made:

- Access to health services within their community—this concern is particularly noted for Lea, which has a non-functioning health centre, and Porebada, which is now opening a new health centre but historically has not had consistent staffing or hours of service.
- General concern related to village level sanitation, particularly accentuated by the noticeable level of plastic debris that is brought in by every high tide.
- Concerns related to alcohol use/abuse and a perceived increase in home brewing and sales to teenagers.
- Consistent observations by both male and female respondents that tuberculosis is a major issue that impacts every household/family.
- Consistent observations by both male and female respondents that malaria is not a major issue in their community.
- Concern that transactional sex is occurring and will rise during peak construction periods.
- A concern among men that diabetes, cardiovascular diseases are increasing and affecting all families, and the level of knowledge among residents is very low about these diseases.
- A strong focus by men on maximising income and employment opportunities associated with future LNG expansion and recognition that monies gained during the PNG LNG Project were not necessarily wisely spent and/or saved.
- A strong statement that influx during construction is not an important worry or concern. Men consistently stated that spontaneous in-migration triggered by construction cannot occur due to socio-cultural conditions, restrictions on land ownership and clear obligations defined by kinship and descent.

## 6.5 Environmental Health Area 1—health systems

The health systems EHA is broad-based and designed to capture baseline information regarding the status and performance of the health care system in the LNG Plant Village area. This assessment includes the suite of health care facilities and programs within the defined LNG Plant villages. The following considerations within this EHA are important:

- Mix of health care facilities (such as aid posts, sub health centres, and health centres).
- Physical state of the available infrastructure during field visits in 2019.
- Facility staffing.
- Equipment and supplies, particularly drugs and laboratory equipment.
- Kinds of programs that are being implemented (such as maternal and childcare, vaccinations, and ANC); disease-specific programs such as HIV/AIDS, tuberculosis, and VBDs are considered in other named EHAs.
- Access to care.

Because of the complexity and length of the health systems EHA analysis, a brief, high-level overview of how the provincial health care system is performing relative to national indicators is introduced. Data from the 2016–2018 DHS study are available; however, these data only present disaggregation at the overall urban and rural level. The NDOH SPAR is the key report where a set of outcome, output and process measures are used to evaluate all 19 Papua New Guinea provinces. The August 2021 SPAR report presents provincial data for 2020. Disaggregated Central Province data are available at the district level, specifically Kairuku-Hiri. Kairuku-Hiri includes more reporting health facilities than Porebada and Papa sub health centres.

NewFields obtained the 2021 SPAR Central Province, Kairuku-Hiri data. In addition, disaggregated 2021 SPAR information for the Papa and Porebada sub health centres were accessed. The 2021 NCD and Papua New Guinea national data were not available; therefore, the 2020 SPAR data for National Capital District and national are presented for comparison.

The SPAR provincial and district data provides a “high-level” benchmark for the subsequent health systems analysis across the LNG Plant villages. The health systems EHA analysis also includes primary source materials from 2019: household surveys, focus group discussions (FGDs), KIIs, and direct field observations made by the health team.

### 6.5.1 Overview of the provincial health care system

The 2021 SPAR provides a snapshot of health sector performance by district for the Central Province. The Kairuku-Hiri District includes the LNG Plant villages (estimated 2019 population 17,000). Table 6-23 presents full year (12 months of submitted data) 2021 SPAR KPI data comparison for the overall Central Province, Kairuku-Hiri District (Central Province), Porebada Sub Health Centre, Papa Sub Health Centre, the 2020 National Capital District, and overall Papua New Guinea national data. As shown in Table 6-23, there is a substantial performance difference between the LNG Hiri villages and both the Kairuku-Hiri District and the overall Central Province performance. The Papa Sub Health Centre has a per capita outpatient visit rate that is over seven-fold higher than Porebada Sub Health Centre. Output measure indicators for the Papa Sub Health Centre are all higher than Porebada Sub Health Centre.

**Table 6-23. Key SPAR indicators 2021 for Central Province, Kairuku-Hiri District, Porebada Sub Health Centre, Papa Sub Health Centre, National Capital District, and National Papua New Guinea**

| Indicator                                                                     | Central Province | Kairuku-Hiri District | Porebada Sub Health Centre | Papa Sub Health Centre | 2020 National Capital District | 2020 Papua New Guinea National |
|-------------------------------------------------------------------------------|------------------|-----------------------|----------------------------|------------------------|--------------------------------|--------------------------------|
| <b>OUTCOME MEASURES</b>                                                       |                  |                       |                            |                        |                                |                                |
| Pneumonia Deaths children < 5, case fatality rate (%)                         | 3%               | 3%                    | 0%                         | 0%                     | 2%                             | 2%                             |
| Malaria- incidence per 1,000- confirmed and clinically diagnosed              | 65               | 121                   | 2                          | 8                      | 22                             | 108                            |
| Diarrheal disease incidence in children <5 years per 1,000 children < 5 years | 130              | 169                   | 44                         | 352                    | 238                            | 178                            |
| Low Birth Weight- % <2,500 grams                                              | 6%               | 4%                    | 9%                         | 6%                     | 9%                             | 7%                             |
| Malnutrition- moderate/severe (z score <2)                                    | 13%              | 15%                   | 7%                         | 9%                     | 10%                            | 17%                            |
| Injury- presentation per 1,000 population                                     | 22               | 26                    | 5                          | 42                     | 24                             | 33                             |
| HIV+ % of pregnant women ages 15-24 who test HIV+                             | 1.8              | 1.6                   | 0                          | 0                      | 1.6                            | 1.3                            |
| <b>OUTPUT MEASURES</b>                                                        |                  |                       |                            |                        |                                |                                |
| Pentavalent vaccination coverage 3 <sup>rd</sup> dose %                       | 45%              | 43%                   | 36%                        | 92%                    | 84%                            | 47%                            |
| Measles Vaccination 9-17 months %                                             | 46%              | 49%                   | 31%                        | 88%                    | 64%                            | 37%                            |
| Facility Births supervised %                                                  | 28%              | 28%                   | 4%                         | 51%                    | 105% <sup>6</sup>              | 40%                            |
| Antenatal Care 1 or more visits                                               | 46%              | 53%                   | 23%                        | 100%                   | 98%                            | 54%                            |
| Family Planning couples year protection/1,000 women of reproductive age       | 58               | 54                    | 11                         | 37                     | 111                            | 81                             |

<sup>6</sup> According to the SPAR 2020 report, “the very high percentage for NCD occurs as women attend from a much larger catchment than just Port Moresby to deliver at PMGH”, p.11.

| Indicator                                           | Central Province | Kairuku-Hiri District | Porebada Sub Health Centre | Papa Sub Health Centre | 2020 National Capital District | 2020 Papua New Guinea National |
|-----------------------------------------------------|------------------|-----------------------|----------------------------|------------------------|--------------------------------|--------------------------------|
| <b>PROCESS MEASURES</b>                             |                  |                       |                            |                        |                                |                                |
| Outreach Clinics per 1,000 children <5 years of age | 56               | 63                    | 34                         | 80                     | 2                              | 29                             |
| Outpatient Visits per person per year               | 1.20             | 0.74                  | 0.24                       | 1.71                   | 1.0                            | 1.3                            |

### 6.5.2 Sources of information

This subsection discusses the health providers, staffing, facilities, and services in the LNG Plant villages as well as provincial health information, medical supply and delivery, and access to health care.

#### Project area of influence health providers, staffing, facilities, and services

LNG Plant Village health services are delivered by Government Health Services and the Salvation Army. Table 6-24 and Table 6-25 present an overview of the staffing and physical facilities for the relevant PNG Plant Village health facilities. As shown in Table 6-24, none of the health facilities are staffed with medical doctors. A license to be a physician in Papua New Guinea requires 7 years of undergraduate training plus 4–6 years of postgraduate training. An HEO (health extension officer; present at Papa Sub Health Centre) has a Bachelor of Health Sciences in Rural Health and practical training; a nurse has a Bachelor of Nursing and practical training; a CHW (community health worker) has completed a 2-year training program (using a standard national curriculum and overseen by NDOH), and a trained village birth attendant (VBA) is a volunteer who has completed a training program developed by NDOH.

**Table 6-24. Project area of influence health facilities—staffing and supervision (2019)**

| Village/Health facility    | Health facility, sponsor, operational status* | Medical doctors | HEO | Nurse | CHWs            | Trained VBA | Non-medical staff |
|----------------------------|-----------------------------------------------|-----------------|-----|-------|-----------------|-------------|-------------------|
| Porebada Sub Health Centre | Government                                    | 0               | 0   | 0     | 1 - not present | 2*          | 0                 |
| Boera Aid Post**           | Government                                    | 0               | 0   | 0     | 1               | 0           | 0                 |
| Papa SC                    | Salvation Army                                | 0               | 1   | 1     | 2               | 0           | 0                 |

\* VBAs were interviewed outside the Aid Post, although the CHW was not present.

\*\* Boera Aid Post closed in January 2022

**Table 6-25. Health facilities—physical infrastructure (2019)**

| Village/Health facility    | Physical infrastructure conditions |             |              |                |                   |         |              |                 |
|----------------------------|------------------------------------|-------------|--------------|----------------|-------------------|---------|--------------|-----------------|
|                            | Building                           | Electricity | Water supply | Toilet latrine | Radio/ cell phone | Boat    | Refrigerator | Microscope, lab |
| Porebada Aid Post (old)    | Yes                                | No          | No           | Unknown        | Unknown           | Unknown | Unknown      | Unknown         |
| Porebada Sub Health Centre | Yes                                | Yes         | Yes          | Yes            | Individual cells  | No      | Yes          | No              |
| Boera Aid Post*            | Yes                                | Yes         | Yes          | Yes            | No                | No      | Broken       | No              |
| Papa Sub Health Centre     | Yes                                | Yes         | Yes          | Yes            | No                | No      | Yes          | No              |

\*Boera Aid Post closed in January 2022

Health care services use was assessed during the household survey that covered a 2-week reporting period (see Table 6-26 and Table 6-27). As illustrated by these data, almost half of the LNG Plant Village households reported using health care services. Porebada had the lowest household level use. Maternal birth KPI data also reflect health service delivery performance. Based on the household surveys, Table 6-28 and Table 6-29 present 2019 KPI data for maternal service delivery performance. As described in the next section, the decreased level of use in Porebada is consistent with the irregular service hours and staffing problems associated with the Porebada Sub Health Centre. As the maternal KPI data clearly demonstrates, the Papa Sub Health Centre is the critical “local” maternal care provider.

**Table 6-26. Health care access by village (2019)**

| Village                  | Number of households surveyed | Number of households reporting using health services | % of households using health services | Number of individuals in the surveyed households | Number of individuals reported to have used health services | % of surveyed population using health services |
|--------------------------|-------------------------------|------------------------------------------------------|---------------------------------------|--------------------------------------------------|-------------------------------------------------------------|------------------------------------------------|
| Boera                    | 92                            | 56                                                   | 61%                                   | 713                                              | 96                                                          | 13%                                            |
| Lea Lea                  | 106                           | 69                                                   | 65%                                   | 859                                              | 84                                                          | 10%                                            |
| Papa                     | 73                            | 46                                                   | 63%                                   | 606                                              | 60                                                          | 10%                                            |
| Porebada                 | 149                           | 74                                                   | 50%                                   | 1,373                                            | 90                                                          | 7%                                             |
| <b>Combined villages</b> | <b>420</b>                    | <b>245</b>                                           | <b>58%</b>                            | <b>3,551</b>                                     | <b>330</b>                                                  | <b>9%</b>                                      |

Table 6-27. Use of health services (2019)

| Demographic              | Number of Individuals in the surveyed population (based on household totals) | Last time someone in the household sought health services                |                                                               |                                                        |                                                                |            |
|--------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------|------------|
|                          |                                                                              | % of surveyed population that were identified as seeking health services | Number of Individuals reported to have sought health services | % for whom advice or treatment was sought <sup>1</sup> | % for how long ago advice or treatment was sought <sup>2</sup> |            |
|                          |                                                                              |                                                                          |                                                               |                                                        | ≤ 2 weeks                                                      | > 2 weeks  |
| <b>Boera</b>             | <b>694</b>                                                                   | <b>13%</b>                                                               | <b>95</b>                                                     |                                                        | <b>46%</b>                                                     | <b>43%</b> |
| Adults (> 5 yrs)         |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 277                                                                          | 12%                                                                      | 34                                                            | 35%                                                    | 47%                                                            | 38%        |
| Male                     | 313                                                                          | 10%                                                                      | 31                                                            | 32%                                                    | 42%                                                            | 39%        |
| Children (≤ 5yrs)        |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 53                                                                           | 38%                                                                      | 20                                                            | 21%                                                    | 50%                                                            | 50%        |
| Male                     | 51                                                                           | 20%                                                                      | 10                                                            | 10%                                                    | 50%                                                            | 50%        |
| <b>Lea Lea</b>           | <b>843</b>                                                                   | <b>10%</b>                                                               | <b>83</b>                                                     |                                                        | <b>82%</b>                                                     | <b>14%</b> |
| Adults (> 5 yrs)         |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 336                                                                          | 7%                                                                       | 23                                                            | 27%                                                    | 74%                                                            | 22%        |
| Male                     | 355                                                                          | 7%                                                                       | 24                                                            | 29%                                                    | 83%                                                            | 8%         |
| Children (≤ 5yrs)        |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 73                                                                           | 29%                                                                      | 21                                                            | 25%                                                    | 90%                                                            | 10%        |
| Male                     | 79                                                                           | 19%                                                                      | 15                                                            | 18%                                                    | 80%                                                            | 20%        |
| <b>Papa</b>              | <b>585</b>                                                                   | <b>10%</b>                                                               | <b>60</b>                                                     |                                                        | <b>70%</b>                                                     | <b>25%</b> |
| Adults (> 5 yrs)         |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 236                                                                          | 9%                                                                       | 22                                                            | 37%                                                    | 50%                                                            | 41%        |
| Male                     | 259                                                                          | 4%                                                                       | 11                                                            | 18%                                                    | 82%                                                            | 18%        |
| Children (≤ 5yrs)        |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 41                                                                           | 24%                                                                      | 10                                                            | 17%                                                    | 70%                                                            | 20%        |
| Male                     | 49                                                                           | 35%                                                                      | 17                                                            | 28%                                                    | 88%                                                            | 12%        |
| <b>Porebada</b>          | <b>1,360</b>                                                                 | <b>7%</b>                                                                | <b>90</b>                                                     |                                                        | <b>66%</b>                                                     | <b>29%</b> |
| Adults (> 5 yrs)         |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 538                                                                          | 6%                                                                       | 34                                                            | 38%                                                    | 59%                                                            | 35%        |
| Male                     | 613                                                                          | 5%                                                                       | 30                                                            | 33%                                                    | 67%                                                            | 30%        |
| Children (≤ 5yrs)        |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 107                                                                          | 7%                                                                       | 8                                                             | 9%                                                     | 63%                                                            | 25%        |
| Male                     | 102                                                                          | 18%                                                                      | 18                                                            | 20%                                                    | 78%                                                            | 17%        |
| <b>Combined villages</b> | <b>3,482</b>                                                                 | <b>9%</b>                                                                | <b>328</b>                                                    |                                                        | <b>65%</b>                                                     | <b>28%</b> |
| Adults (> 5 yrs)         |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 1,387                                                                        | 8%                                                                       | 113                                                           | 34%                                                    | 57%                                                            | 35%        |
| Male                     | 1,540                                                                        | 6%                                                                       | 96                                                            | 29%                                                    | 65%                                                            | 26%        |
| Children (≤ 5yrs)        |                                                                              |                                                                          |                                                               |                                                        |                                                                |            |
| Female                   | 274                                                                          | 22%                                                                      | 59                                                            | 18%                                                    | 69%                                                            | 27%        |
| Male                     | 281                                                                          | 21%                                                                      | 60                                                            | 18%                                                    | 77%                                                            | 22%        |

1. Percentage is based on the total of number of individuals in the village that was reported to have sought health services

2. Percentage is based on the age-gender demographic of individuals in the village that was reported to have sought health services

Table 6-28. Children under 5 years of age—mother birth experience and location (2019)

| Demographic     | Adult Female Population | Number of mothers responding              |                  |                                  | Location of birth |                             |            |             |
|-----------------|-------------------------|-------------------------------------------|------------------|----------------------------------|-------------------|-----------------------------|------------|-------------|
|                 |                         | Percentage of the adult female population | Number of births | Percentage of responding mothers | Hospital          | Sub health centre/ aid post | Village    | Unspecified |
| <b>Boera</b>    | <b>277</b>              | <b>17%</b>                                | <b>47</b>        |                                  | <b>60%</b>        | <b>32%</b>                  | <b>6%</b>  | <b>2%</b>   |
| <1 year ago     |                         |                                           | 1                | 2%                               | 100%              | --                          | --         | --          |
| 1-2 years ago   |                         |                                           | 9                | 19%                              | 56%               | 33%                         | --         | 11%         |
| 2-3 years ago   |                         |                                           | 9                | 19%                              | 44%               | 44%                         | 11%        | --          |
| 3-4 years ago   |                         |                                           | 16               | 34%                              | 75%               | 19%                         | 6%         | --          |
| 4-5 years ago   |                         |                                           | 5                | 11%                              | 60%               | 20%                         | 20%        | --          |
| 5-6 years ago   |                         |                                           | 7                | 15%                              | 43%               | 57%                         | --         | --          |
| <b>Lea Lea</b>  | <b>336</b>              | <b>29%</b>                                | <b>98</b>        |                                  | <b>29%</b>        | <b>21%</b>                  | <b>49%</b> | <b>1%</b>   |
| <1 year ago     |                         |                                           | 1                | 1%                               | --                | 100%                        | --         | --          |
| 1-2 years ago   |                         |                                           | 28               | 29%                              | 25%               | 32%                         | 39%        | 4%          |
| 2-3 years ago   |                         |                                           | 12               | 12%                              | 17%               | 17%                         | 67%        | --          |
| 3-4 years ago   |                         |                                           | 23               | 23%                              | 26%               | 22%                         | 52%        | --          |
| 4-5 years ago   |                         |                                           | 17               | 17%                              | 35%               | 18%                         | 47%        | --          |
| 5-6 years ago   |                         |                                           | 17               | 17%                              | 41%               | 6%                          | 53%        | --          |
| <b>Papa</b>     | <b>236</b>              | <b>30%</b>                                | <b>70</b>        |                                  | <b>34%</b>        | <b>60%</b>                  | <b>4%</b>  | <b>1%</b>   |
| <1 year ago     |                         |                                           | 5                | 7%                               | 60%               | 40%                         | --         | --          |
| 1-2 years ago   |                         |                                           | 19               | 27%                              | 37%               | 63%                         | --         | --          |
| 2-3 years ago   |                         |                                           | 9                | 13%                              | 33%               | 67%                         | --         | --          |
| 3-4 years ago   |                         |                                           | 13               | 19%                              | 38%               | 46%                         | 15%        | --          |
| 4-5 years ago   |                         |                                           | 14               | 20%                              | 21%               | 64%                         | 7%         | 7%          |
| 5-6 years ago   |                         |                                           | 9                | 13%                              | 22%               | 78%                         | --         | --          |
| Unspecified     |                         |                                           | 1                | 1%                               |                   |                             |            |             |
| <b>Porebada</b> | <b>1,373</b>            | <b>10%</b>                                | <b>136</b>       |                                  | <b>85%</b>        | <b>6%</b>                   | <b>9%</b>  | <b>1%</b>   |
| <1 year ago     |                         |                                           | 3                | 2%                               | 67%               | 33%                         | --         | --          |
| 1-2 years ago   |                         |                                           | 27               | 20%                              | 93%               | --                          | 4%         | 4%          |
| 2-3 years ago   |                         |                                           | 18               | 13%                              | 72%               | 6%                          | 22%        | --          |
| 3-4 years ago   |                         |                                           | 36               | 26%                              | 83%               | 8%                          | 8%         | --          |
| 4-5 years ago   |                         |                                           | 24               | 18%                              | 88%               | 4%                          | 8%         | --          |

Table 6-28. Children under 5 years of age—mother birth experience and location (2019)

| Demographic              | Adult Female Population | Number of mothers responding              |                  |                                  | Location of birth |                             |            |             |
|--------------------------|-------------------------|-------------------------------------------|------------------|----------------------------------|-------------------|-----------------------------|------------|-------------|
|                          |                         | Percentage of the adult female population | Number of births | Percentage of responding mothers | Hospital          | Sub health centre/ aid post | Village    | Unspecified |
| 5-6 years ago            |                         |                                           | 27               | 20%                              | 85%               | 7%                          | 7%         | --          |
| Unspecified              |                         |                                           | 1                | 1%                               | 100%              | --                          | --         | --          |
| <b>Combined villages</b> | <b>3,551</b>            | <b>10%</b>                                | <b>351</b>       |                                  | <b>56%</b>        | <b>25%</b>                  | <b>19%</b> | <b>1%</b>   |
| <1 year ago              |                         |                                           | 10               | 3%                               | 60%               | 40%                         | --         | --          |
| 1-2 years ago            |                         |                                           | 83               | 24%                              | 53%               | 29%                         | 14%        | 4%          |
| 2-3 years ago            |                         |                                           | 48               | 14%                              | 46%               | 27%                         | 27%        | --          |
| 3-4 years ago            |                         |                                           | 88               | 25%                              | 60%               | 19%                         | 20%        | --          |
| 4-5 years ago            |                         |                                           | 60               | 17%                              | 55%               | 23%                         | 20%        | 2%          |
| 5-6 years ago            |                         |                                           | 60               | 17%                              | 58%               | 23%                         | 18%        | --          |
| Unspecified              |                         |                                           | 2                | 1%                               | 100%              | --                          | --         | --          |

Note: The timing of the birth is based on the age of the child. All statistics are based on live births.

Table 6-29. Children under 5 years of age—mother birth experience—birth and antenatal care (2019)

| Demographic     | Number of births | % of village births supervised by: |             |                 |              | % for ANC attendance during pregnancy |           |             |
|-----------------|------------------|------------------------------------|-------------|-----------------|--------------|---------------------------------------|-----------|-------------|
|                 |                  | APO                                | Trained VBA | Traditional VBA | Un-specified | Yes                                   | No        | Unspecified |
| <b>Boera</b>    | <b>47</b>        | <b>11%</b>                         | <b>11%</b>  | <b>4%</b>       | <b>74%</b>   | <b>94%</b>                            | <b>2%</b> | <b>4%</b>   |
| <1 year ago     | 1                | --                                 | --          | --              | 100%         | 100%                                  | --        | --          |
| 1-2 years ago   | 9                | 22%                                | --          | --              | 78%          | 100%                                  | --        | --          |
| 2-3 years ago   | 9                | 22%                                | 11%         | 11%             | 56%          | 100%                                  | --        | --          |
| 3-4 years ago   | 16               | --                                 | 13%         | --              | 88%          | 81%                                   | 6%        | 13%         |
| 4-5 years ago   | 5                | --                                 | --          | 20%             | 80%          | 100%                                  | --        | --          |
| 5-6 years ago   | 7                | 14%                                | 29%         | --              | 57%          | 100%                                  | --        | --          |
| <b>Lea Lea</b>  | <b>98</b>        | <b>8%</b>                          | <b>18%</b>  | <b>31%</b>      | <b>43%</b>   | <b>99%</b>                            | <b>--</b> | <b>1%</b>   |
| <1 year ago     | 1                | --                                 | 100%        | --              | --           | 100%                                  | --        | --          |
| 1-2 years ago   | 28               | 18%                                | 29%         | 14%             | 39%          | 96%                                   | --        | 4%          |
| 2-3 years ago   | 12               | 8%                                 | 8%          | 58%             | 25%          | 100%                                  | --        | --          |
| 3-4 years ago   | 23               | 4%                                 | 9%          | 39%             | 48%          | 100%                                  | --        | --          |
| 4-5 years ago   | 17               | 6%                                 | 18%         | 24%             | 53%          | 100%                                  | --        | --          |
| 5-6 years ago   | 17               | --                                 | 18%         | 35%             | 47%          | 100%                                  | --        | --          |
| <b>Papa</b>     | <b>70</b>        | <b>24%</b>                         | <b>16%</b>  | <b>1%</b>       | <b>59%</b>   | <b>77%</b>                            | <b>9%</b> | <b>14%</b>  |
| <1 year ago     | 5                | --                                 | 20%         | --              | 80%          | 60%                                   | 20%       | 20%         |
| 1-2 years ago   | 19               | 26%                                | 21%         | --              | 53%          | 89%                                   | 5%        | 5%          |
| 2-3 years ago   | 9                | 33%                                | 11%         | --              | 56%          | 78%                                   | 11%       | 11%         |
| 3-4 years ago   | 13               | 23%                                | 15%         | --              | 62%          | 77%                                   | --        | 23%         |
| 4-5 years ago   | 14               | 21%                                | 7%          | 7%              | 64%          | 57%                                   | 21%       | 21%         |
| 5-6 years ago   | 9                | 33%                                | 22%         | --              | 44%          | 89%                                   | --        | 11%         |
| Unspecified     | 1                |                                    |             |                 |              |                                       |           |             |
| <b>Porebada</b> | <b>136</b>       | <b>4%</b>                          | <b>29%</b>  | <b>9%</b>       | <b>59%</b>   | <b>88%</b>                            | <b>2%</b> | <b>10%</b>  |
| <1 year ago     | 3                | --                                 | 100%        | --              | --           | 100%                                  | --        | --          |
| 1-2 years ago   | 27               | --                                 | 19%         | --              | 81%          | 81%                                   | 4%        | 15%         |
| 2-3 years ago   | 18               | 6%                                 | 17%         | 22%             | 56%          | 94%                                   | --        | 6%          |
| 3-4 years ago   | 36               | 8%                                 | 31%         | 8%              | 53%          | 86%                                   | 6%        | 8%          |
| 4-5 years ago   | 24               | 4%                                 | 21%         | 13%             | 63%          | 83%                                   | --        | 17%         |
| 5-6 years ago   | 27               | --                                 | 44%         | 7%              | 48%          | 96%                                   | --        | 4%          |
| Unspecified     | 1                | --                                 | --          | --              | 100%         | 100%                                  | --        | --          |

Table 6-29. Children under 5 years of age—mother birth experience—birth and antenatal care (2019)

| Demographic              | Number of births | % of village births supervised by: |             |                 |              | % for ANC attendance during pregnancy |           |             |
|--------------------------|------------------|------------------------------------|-------------|-----------------|--------------|---------------------------------------|-----------|-------------|
|                          |                  | APO                                | Trained VBA | Traditional VBA | Un-specified | Yes                                   | No        | Unspecified |
| <b>Combined villages</b> | <b>351</b>       | <b>10%</b>                         | <b>21%</b>  | <b>13%</b>      | <b>56%</b>   | <b>90%</b>                            | <b>3%</b> | <b>7%</b>   |
| <1 year ago              | 10               | --                                 | 50%         | --              | 50%          | 80%                                   | 10%       | 10%         |
| 1-2 years ago            | 83               | 14%                                | 20%         | 5%              | 60%          | 90%                                   | 2%        | 7%          |
| 2-3 years ago            | 48               | 15%                                | 13%         | 25%             | 48%          | 94%                                   | 2%        | 4%          |
| 3-4 years ago            | 88               | 8%                                 | 19%         | 14%             | 59%          | 88%                                   | 3%        | 9%          |
| 4-5 years ago            | 60               | 8%                                 | 15%         | 15%             | 62%          | 83%                                   | 5%        | 12%         |
| 5-6 years ago            | 60               | 7%                                 | 32%         | 13%             | 48%          | 97%                                   | --        | 3%          |
| Unspecified              | 2                | --                                 | --          | --              | 100%         | 100%                                  | --        | --          |

Note: The timing of the birth is based on the age of the child. All statistics are based on live births.

### LNG Plant villages health facilities descriptions

This subsection describes key providers of health services, either through Government or through the Salvation Army Services.

#### Overview

The overall utilisation patterns for health services across the LNG Plant villages were discussed in the morbidity (burden of disease) analysis in Section 6.3. Each of the key health facilities is presented and discussed in the next sections based on the 2019 field surveys.

#### Porebada Sub Health Centre (2019)

This section discusses the services provided and infrastructure for Porebada Sub Health Centre.

#### **Services provided**

According to past Porebada Sub Health Centre data sheets, general health services are provided, although this was not verified during the 2019 HIA team visit, as the current aid post was closed. According to the Kairuku-Hiri District Health personnel, the CHW at Porebada was transferred to the Hiri Clinic at Konedobu, which burned down in 2019. The Mineral Resources Authority (MRA) has constructed a new clinic. However, as of the 2019 health team field visit, there had been no formal transition of staff, facilities, supplies, or services. In addition, the CHW was not available for an interview.

#### **Infrastructure**

The Porebada Sub Health Centre was not open during the health team field visit in 2019. The new sub health centre building was partially equipped, contained some basic supplies, and was open for clinical patients; however, the Save the Children tuberculosis outreach programme was using the facility. This building, if properly staffed and supplied could improve service availability for Porebada residents. Porebada has a high percentage of residents who seek health services in POM. As illustrated in Table 6-23, the full year 2021 data indicates that the Porebada Sub Health Centre is open and operating as 12 months of monthly data were submitted to eNHIS based on 2021 data.

Discussions held with women in the community (including birth attendants) indicated the following health issues as concerns:

- Maternal child health:
  - Women delivering at home and newborns at home without treatment when needed; the only training attended by the VBAs was in 2007. The lack of maternal delivery services in Porebada is reflected in the household survey data which indicate that only 6% delivered at the clinic versus travelling to a hospital (85%).
  - Personal hygiene, especially with women who ignore hygiene after delivery which results in infections.
  - Poor community hygiene; children playing in unsanitary conditions.
  - No transportation when needed for deliveries with complications.
  - Cervical cancer, no treatment available in POM, except from private hospitals that are expensive; must travel to Lae, reportedly Susu Mamas (an NGO that supports and promotes breast feeding for infants) can assist.
  - Girls become pregnant when very young, without knowing the father.

Plate 1. Porebada Sub Health Centre in 2019



Plate 2. New clinic building, supplies in Porebada



Plate 3. New clinic building, equipment, and exam room



- Increase in tuberculosis, including MDR patients.
- Marital communication—the group stated that the Tokout Tokstret program, supported by the PNG LNG Project and conducted by Population Services International (PSI), several years ago was effective and should be continued.
- Teens and alcohol; homemade versions are very cheap and accessible.
- Very young children, as young as 10 years are mixing lime powder (used with betel nut) with cigarette ash and either putting it in the mouth (sublingual) or inhaling it, causing major behaviour issues (“they go crazy”).
- Nutrition—the same food is consumed every day (rice and tin fish) with no garden vegetables
- Domestic animals roaming the village.
- Availability of the CHW in Porebada who reportedly rarely opens the clinic; therefore, health care is very limited.
- Lack of first aid training.

Discussions with male representatives from Porebada raised few concerns regarding health and invariably returned to topics focusing on income opportunities and employment. These discussions are quite consistent with the findings captured by the Tetra Tech Coffey social teams. In terms of health, the men expressed concerns over tuberculosis, which they felt was spreading across the village. The Save the Children tuberculosis programme staff expressed concern that while they were identifying a substantial number of patients it was extremely difficult to ensure accurate diagnosis and treatment initiation as this required evaluation in POM.

### Boera Aid Post (2019) (closed as of January 2022)

The CHW (grade 6) had been the only health staff in Boera as the CHW for 19 years. The clinic was open Monday through Friday from 8:00 am to 4:00 pm; however, he saw patients on weekends and evenings whenever needed. Overnight care was not available unless necessary; these cases are referred to POM General Hospital. There is no transportation or ambulance service for the aid post, and there is no formal communication equipment (cell phone, radio, and so on). To obtain supplies and medications, Sana completed an order form, took a dingy to the Porebada Sub Health Centre, and obtained the medicine and supplies from the CHW at Porebada. The Boera CHW was not able to obtain all the medications and supplies needed, and this was duly noted at the clinic. Water for the aid post was supplied by a rainwater tank, which did not have enough capacity for the dry season.

During the rainy season, the clinic roof leaks and negatively impacts the aid post. Hand washing is available outside by the latrine. There are two latrines behind the CHWs home that are supposed to be for the aid post; however, one is used by the village, the other is kept locked for aid post use. The aid post latrine is almost full. Medical waste that contains potential pathogenic materials and sharps are dumped into the aid post latrine. Other aid post refuse is burned beside the latrine in an open pit.

The aid post sterilisation method was to wash equipment with Savlon soap, as there were no autoclaves, pressure cookers, and so on. Electricity was available but the aid post refrigerator was broken; therefore, cold chain could not be maintained, and no vaccines were available. A cold chain is a low temperature-controlled supply chain network. Immunisations are normally provided by Hiri District clinic at Konedobu, but since it burned down patients are sent to Gerehu or to POM General Hospital. When immunisation clinics are held, the mothers reportedly are responsible for bringing and maintaining their children's vaccination health cards. Sana conducted ANC visits and delivered babies at the aid post. Complications were referred to POM. Marie Stopes International (MSI) occasionally conducted family planning clinics, which included birth control implants.

There were no lab capabilities and no supplies to test blood or urine glucose for diabetes. RDTs for malaria were available but not on a consistent basis. Sana stated at the time that he had not diagnosed any RDT positive malaria cases.

Suspected tuberculosis cases were referred to Gerehu Clinic/General Hospital or to Port Moresby General Hospital. There were two tuberculosis volunteers in Boera who were supposed to be trained through the Save the Children tuberculosis programme. Sana had a list of people in Boera who are on treatment at the time (six people). He did not have the treatment cards. There were no protective masks available in the aid post.

When men came to Sana with complaints of pain and urethral discharge, they were presumptively diagnosed with an STI and treated with doxycycline or amoxicillin. Sana attempted contact tracing for partners, but this typically did not happen. Those with symptoms or concerns are referred to POM General Hospital for further testing. At the time, Sana knew of four people in Boera who were under HIV treatment.

The following other observations were made by the Boera CHW:

- No one from Hiri District had conducted supervisory visits nor visited the Boera Aid Post for 2 years preceding 2019.
- ExxonMobil Community Affairs personnel conducted roadway safety awareness in local schools on a quarterly basis during 2019.

### **Focus group discussions (2019)**

The following concerns were gathered from group discussions of males and females.

### *Females*

Group discussions focused on health with local Boera women indicated the following health concerns:

- Cervical cancer in women (ages 40 and over)—the women were not aware of the human papilloma virus (HPV) vaccine, which can provide protection against HPV related cervical cancer.
- HIV/AIDs.
- Tuberculosis—PNG IMR has two local staff members in Boera who assist with tuberculosis treatment once per month. They reportedly test for tuberculosis in the community once per year. Specimens are sent to Goroka with the results reported to the IMR office in POM. The IMR team member brings results to Boera, but not to the CHW. There are about five people on the treatment list, three of which are extrapulmonary tuberculosis. According to the IMR representative, they do not work through the aid post in Boera nor do they routinely share information with the CHW. No case contact tracing occurs.
- Malaria.
- Snake bite.
- Aid post staffing—would like to see more staff support. Sana's wife assists during deliveries; however, he is charging 100 Kina (US\$29.43) per delivery and some women cannot afford it. It is reportedly rare to deliver at home: "the aid post is a good place to deliver." Delivery complications are referred to POM General Hospital, which requires hiring local transport at 200 to 300 Kina (US\$59.00–88.00). Some women go to Papa for antenatal visits and delivery.
- There is a lack of access to medications that are needed for adequate treatment.
- Lack of access to clean water for drinking, bathing, and cooking.
- Teen pregnancy—young girls need more education regarding sexual health and birth control. Some girls as young as 13 become pregnant. MSI comes to Boera occasionally to provide family planning services.

During discussions regarding cervical cancer concerns, there was no knowledge among the women regarding the existence of the HPV vaccination.

### *Males*

There was a strong focus on economic and employment issues, particularly regarding the proposed future LNG expansion work. Respondents repeatedly expressed concern that during the initial PNG LNG Project the community did not maximize potential long-term benefits and instead simply focused on short-term economic gains. In terms of health issues, the key concerns were related to tuberculosis, substance abuse, and a potential increase in transactional sex activity triggered by a sudden surge in employment and income.

### Papa Sub Health Centre (2019)

In 2019 there were four staff members at the clinic:

- One HEO
- Two CHWs
- One Registered Nursing Officer

As of 2023, there are five staff members at the clinic:

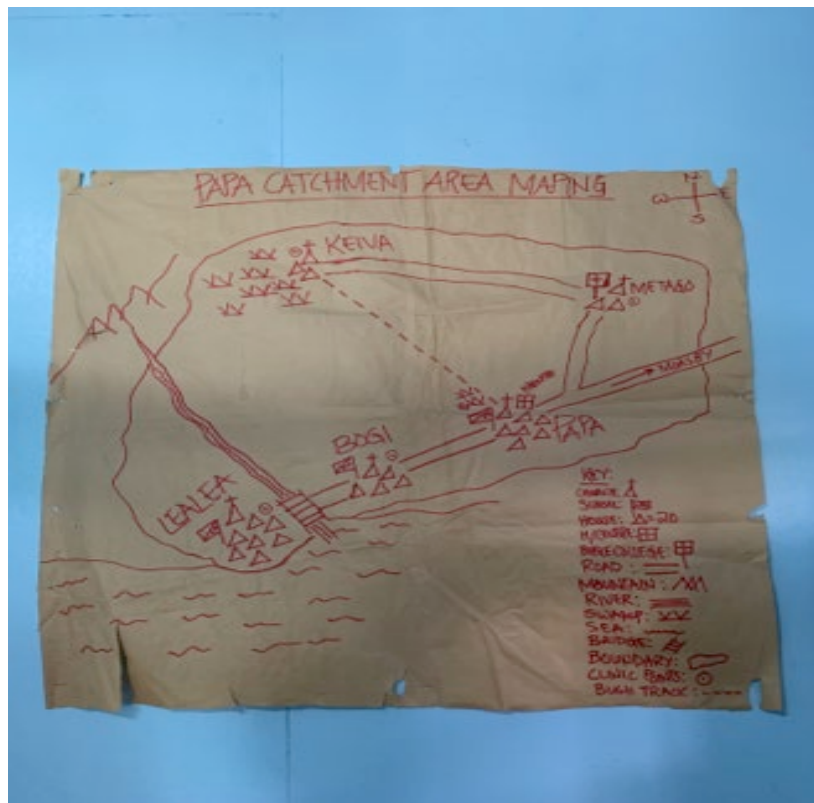
- One HEO

## Papua LNG Project – Downstream | Community Health Baseline

- Four HEW
- The registered nurse has left the clinic.

According to the HEO in charge, the staff is responsible. A map posted in the clinic (shown in Plate 4) shows the general patient catchment area; however, according to the HEO, the actual service catchment area is larger and includes more villages.

**Plate 4. Papa Sub Health Centre catchment area**



The HEO does not see RDT confirmed malaria from the Project area villages, only from patients who are from more inland areas.

There are 28 known active tuberculosis cases with an approximately 10% default rate (patients not taking anti-tuberculosis drugs for two months or more, consecutively after starting treatment). World Vision is conducting a tuberculosis programme in Papa using established WHO protocols; however, this programme is not connected to or coordinated with the Papa Sub Health Centre. Similarly, there is no apparent coordination between the “Save the Children Tuberculosis Program” in Porebada and similar efforts in Papa.

Women are charged 20 Kina (US\$5.89) for deliveries, compared to 100 Kina (US\$29.43) at Boera and Porebada. Patients come from all LNG area villages for antenatal care and deliveries. Complications are referred to POM General Hospital. Antenatal clinics are organised and regularly held one day a week and child health/immunisation clinics are also held one day per week. Children who are seen with fractures are splinted and referred for further diagnosis and treatment.

The clinic buildings (main patient treatment areas and the old PNG IMR laboratory building) appear to be in a state of disrepair. Multiple women go through labour and deliver babies in one delivery room. Other patient care areas were observed to be extremely crowded and consistent with the large patient use recorded in the Papa Sub Health Centre monthly records.

**Plate 5. Papa Sub Health Centre delivery and patient care areas**



In the past, the PNG LNG Project provided building materials to the Salvation Army for building upgrades and improvements; however, these infrastructure upgrades were reportedly not completed by Salvation Army management as expected. According to ExxonMobil PNG Community Affairs staff, there was excess materials left over after completion that were handed over to the Papa Sub Health Centre in 2017/18.

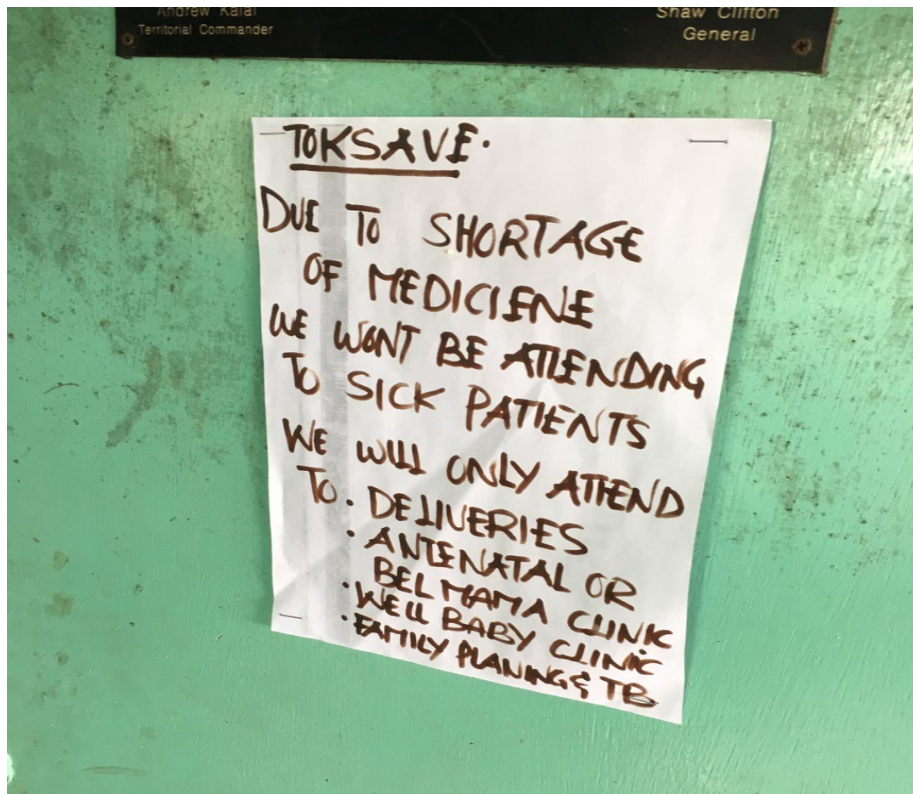
In 2019, the PNG IMR laboratory building is reportedly full of termites, was locked, and not in use. According to ExxonMobil PNG Community Affairs staff, as of 2023 the PNG IMR laboratory building has not undergone any maintenance. It has been reopened for TB testing, and HIV/AIDs testing and counselling.

Locally, according to the HEO, the health staff is organised, shows up for work consistently, and treats numerous patients and illness types. According to ExxonMobil PNG Community Affairs staff, the HEO is respected among community members in all surrounding areas. According to ExxonMobil PNG Community Affairs staff, the Salvation Army conducts regular visits to health services.

Medications and supplies are insufficient to manage the patient volume and requirements. A notice placed prominently in the Papa Sub Health Centre is shown Plate 6.

Full year eNHIS 2021 (see Table 6-23) data shows that the Papa Sub Health Centre is seeing a substantial number of outpatients and delivering a high level of services relative to Porebada Sub Health Centre.

Plate 6. Notice of medicine shortage at the Papa Sub Health Centre



Lea Lea (2019)

Discussions held with women in the community indicated the following health issues as concerns:

- Sanitation, hygiene, and sewage:
  - Only a few houses in the main village have pit toilets; most use the sea or bush
  - Villagers bathe in the river and use gardens as toilet areas
  - "Fish eat the waste; we catch the fish and eat the fish containing the waste"
  - Stomach problems and diarrhoea are increasing, mostly in children
- Lack of access to clean water for drinking.
- No health care available in the village, other than a few birth attendants; most go to Papa Sub Health Centre for ANC visits, immunisations, deliveries, and so on; a building was constructed in Lea Lea by a "member" a few years ago but was never completed, there are no staff.
- Cervical cancer is common.
- Diabetes and hypertension are on the rise (among men and women); hypertension is also a problem with pregnant women, stroke is occurring.
- Tuberculosis—many go to Papa Sub Health Centre for testing, "some have swollen stomachs, skin colour turns black, some have died," "some have tuberculosis in the stomach and bone."
- Young girls having babies outside marriage.
- It's common for single mothers to sell sex for money; however, there are no outside sex workers.

- Drug abuse.
- Alcohol abuse with homemade brew, which can easily be made with yeast and sugar. Home brew is a major source of income; pregnant women abuse alcohol, which results in deformed babies; additionally, young children abuse alcohol.
- Very young children are mixing lime powder (used with betel nut) with cigarette ash and either putting it in the mouth (sublingual) or inhaling it, causing major behaviour issues; recently a meeting was held where several kids were identified as users and told to stop—no effect at all.

During discussions regarding cervical cancer concerns, as in Porebada, there was no knowledge among the women regarding the existence of the HPV vaccination.

### **Males**

Consistent with the other male FGDs, there was a significant emphasis on income and employment opportunities. Interviewees expressed the opinion that the village had moved from subsistence to a wage/cash economy and lifestyle. There were marked concerns regarding sanitation issues, particularly related to plastic debris along beaches. Tuberculosis was repeatedly voiced as a significant health concern, along with substance abuse, particularly related to home brew production and sales. Increases in tobacco usage among young adults were observed. Sorcery/witchcraft was felt to be a significant issue that affected the ability to roll out health programmes.

As noted in the individual health facility discussions, timely delivery of medical supplies and equipment is a significant issue and is analysed in the next section.

### **Medical supply and delivery**

There is an ordering and distribution schedule and system that begins with the aid post/health centre completing their order form and submitting it to the area medical store (AMS) in Port Moresby. Orders are required to be received at the AMS in the first week of every ordering month. Order forms are either hand carried or emailed to the AMS. Often supplies received do not include everything ordered. Some items that are sent by AMS are either not needed or not appropriate for the level of care available at the aid post or health centre. According to information obtained from the Rural Primary Health Services Delivery Project, NDOH, POM), there are long-standing issues with the medical supply delivery system. The AMS receives order forms, fills the order with the medicines and supplies they have available (often the AMS is short of supplies), and the transportation contractor picks up the order and stores it in a warehouse until there is a vehicle load full for delivery to the geographic area where the aid post/hospital is located. This can sometimes take months. Research conducted in Papua New Guinea recently found that the factors influencing the availability of medical supplies consist of a range of interrelating issues that can be classified under tools; skills; workers and infrastructure; and structures, systems and roles. These issues consist of both simple and complex problems involving the different levels and cadres of workers within the medical supply chain (Brown and Gilbert 2014). That there have been problems with virtually every aspect of procurement and distribution functions of NDOH is well known and well documented. The main reasons for these problems are wide ranging: from leadership to institutional framework; from lack of administrative infrastructure to other capacity constraints; and from leakages of funds and medical supplies to regressive behaviour of some officials and staff towards a positive change (World Bank 2014).

#### Medical supply delivery – Project area

**Boera.** Submitted order list to Porebada Sub Health Centre, where the order is added to the Porebada list and submitted to the AMS whenever the CHW is able to take the list to the AMS. When the supplies are either delivered to Porebada or the CHW picks them up, the order for Boera is taken

from whatever is received for the Porebada Sub Health Centre. The Boera CHW used a boat to travel to Porebada and retrieve the supplies. The supplies are never all that was ordered.

**Papa.** Submits order list to the AMS either by travelling to POM or through providing the order list to the transport delivery carrier when they arrive. According to health staff, medical supplies are not delivered by the Salvation Army HQ office in POM. Medicines and supplies orders submitted in January 2019 had still not been delivered at the time of this assessment, 6 months later.

### Summary

- **The 2022 health system infrastructure across the LNG Plant villages includes two sub health centres: Papa and Porebada.**
  - **This structure and its associated programs are mandated by the NDOH but managed by the Central Province.**
- **Based on 2021 eNHIS data, both LNG Plant villages SCs are delivering services.**
- **Based on 2021 eNHIS data, the majority of direct health care service and program delivery, such as immunisations and antenatal services, are delivered by the Papa Sub Health Centre.**

## 6.6 Environmental Health Area 2—communicable respiratory diseases

EHA 2 considers the burden of communicable respiratory diseases including COVID-19. The transmission of communicable respiratory diseases is strongly associated with overcrowding (high household occupancy); cooking/heating with wood as a primary fuel source; low immunisation levels in children and adults; and poor hygiene, particularly hand washing practices (Baker et al. 2013). The following factors are “at play” within the LNG Plant villages: (1) household occupancy sizes are between 7–9 depending upon the specific village; (2) wood is an extremely common fuel source for cooking; (3) immunisation levels for the common pre-COVID-19 communicable infectious diseases are well below WHO targets of >80%; (4) nationally, fully vaccinated COVID-19 levels were 5.9% and Central Province levels were 3.9% (20 November 2022); and (5) hygiene/sanitation levels at both village and household level are low.

Based on health facility morbidity data (EHA 1—Health Systems), respiratory illness is the leading cause of reported morbidity across the LNG Plant villages. The actual microbiological aetiology of this disease burden in the LNG Plant villages is unknown. A COVID-19 diagnosis is made primarily based on symptoms without laboratory testing. For example, between 5 and 11 September 2022, there was one reported COVID-19 test reported by the Central Province (NDOH and WHO 2022). Aside from ongoing COVID-19 issues, the tuberculosis situation in the LNG Plant villages is an ongoing concern (personal communication ExxonMobil LNG Medicine and Occupational Health Department October 2022).

### 6.6.1 Overview

Respiratory illness can be caused by many different aetiologies, including numerous species of bacteria, virus, protozoa, and fungi. Although bacterial pathogens, particularly *Hemophilus influenzae* and *Streptococcus pneumoniae*, are typically identified as the major cause of acute lower respiratory illness, viral agents are also considered important agents in the disease process. Various studies have identified viral species as the etiological agent of acute lower respiratory tract infections (ALRI) in 20–48% of Papua New Guinea cases examined by research scientists (Hare et al. 2010; Greenberg and Leibovitz 2005; Zar and Madhi 2006; Johnstone et al. 2008; Jennings et al. 2008; Angeles et al. 2006; de Roux et al. 2004; Chidlow et al. 2012). Previous work by PNG IMR is consistent with these observations (Hare et al. 2010).

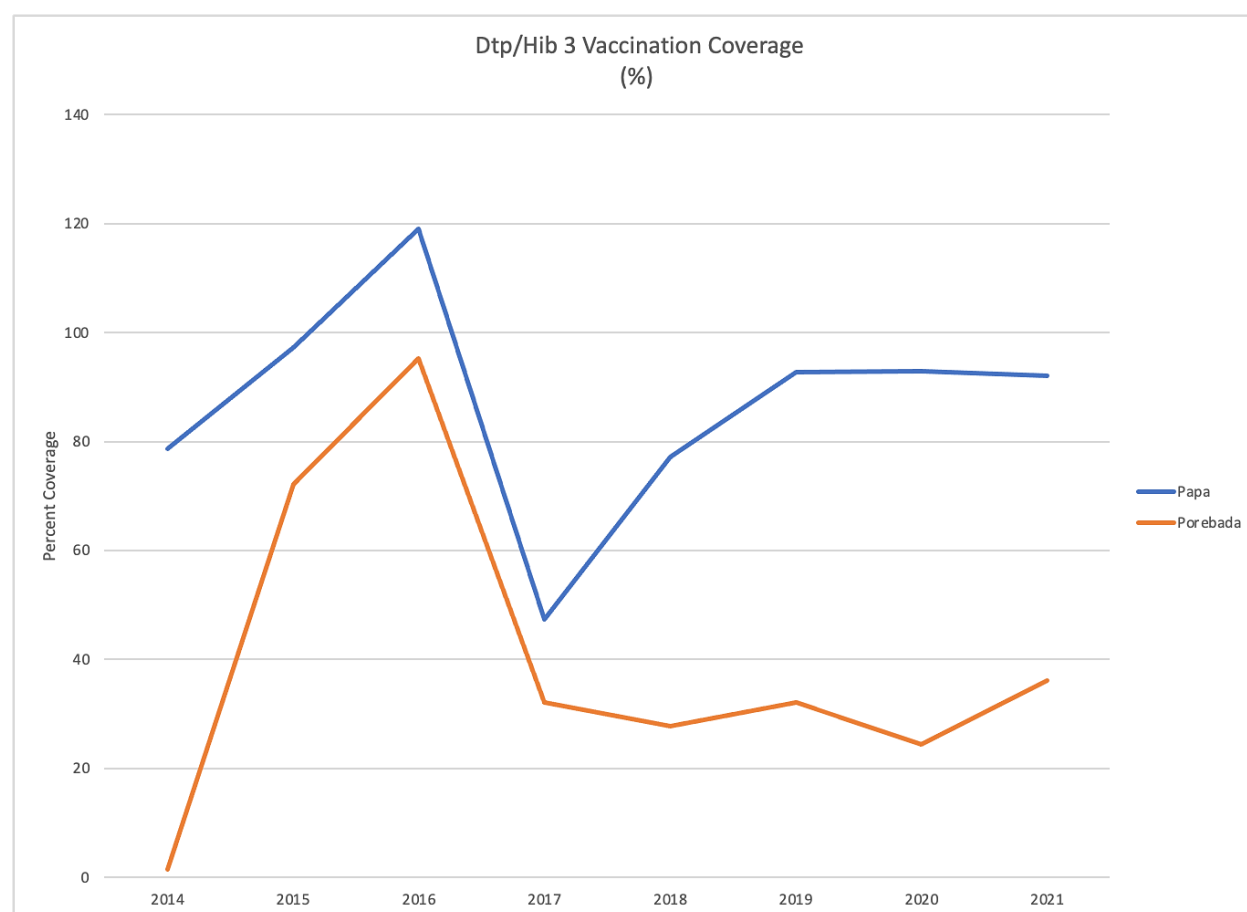
#### **Vaccine preventable disease: Measles and diphtheria/pertussis/haemophilus influenzae type B**

An indication of the level of vaccine-preventable illness across the LNG Plant villages is provided through an evaluation of clinic data collected locally. These data, presented in the discussion of LNG Plant Village morbidity data, indicate that respiratory diseases are the leading cause of disease, although it is unknown whether these diagnoses would be vaccine preventable.

The overall rates of vaccine preventable disease can be potentially significant given the variable vaccination rates documented in children at the Porebada and Papa sub health centres (see Table 6-23). Similarly, there is a significant burden of vaccine preventable illness, like pneumonia, in adults. Papua New Guinea has one of the highest rates of adult pneumonia in the world (Riley 2010; Douglas 2010).

When community vaccination levels are low, typically less than 80% for the target group, there is a loss of “herd immunity.” According to VaccinesToday (2015), “herd immunity is a form of immunity that occurs when the vaccination of a significant portion of a population (or herd) provides a measure of protection for individuals who have not developed immunity.” Herd immunity rises when a high percentage of the population is protected through vaccination against a virus or bacteria, making it difficult for a disease to spread because there are so few susceptible people left to infect. Hence, the likelihood of a sudden infectious disease outbreak is lessened. At a community level, herd immunity can effectively stop the spread of a disease in a community even if a few isolated cases occur. The proportion of the population that must be immunised to achieve herd immunity varies for each disease. When immunisation rates fall, herd immunity can break down, leading to an increase in the risk of a sudden disease outbreak. The risk of an outbreak of a communicable respiratory infection from either a community or workplace setting is described in subsequent sections.

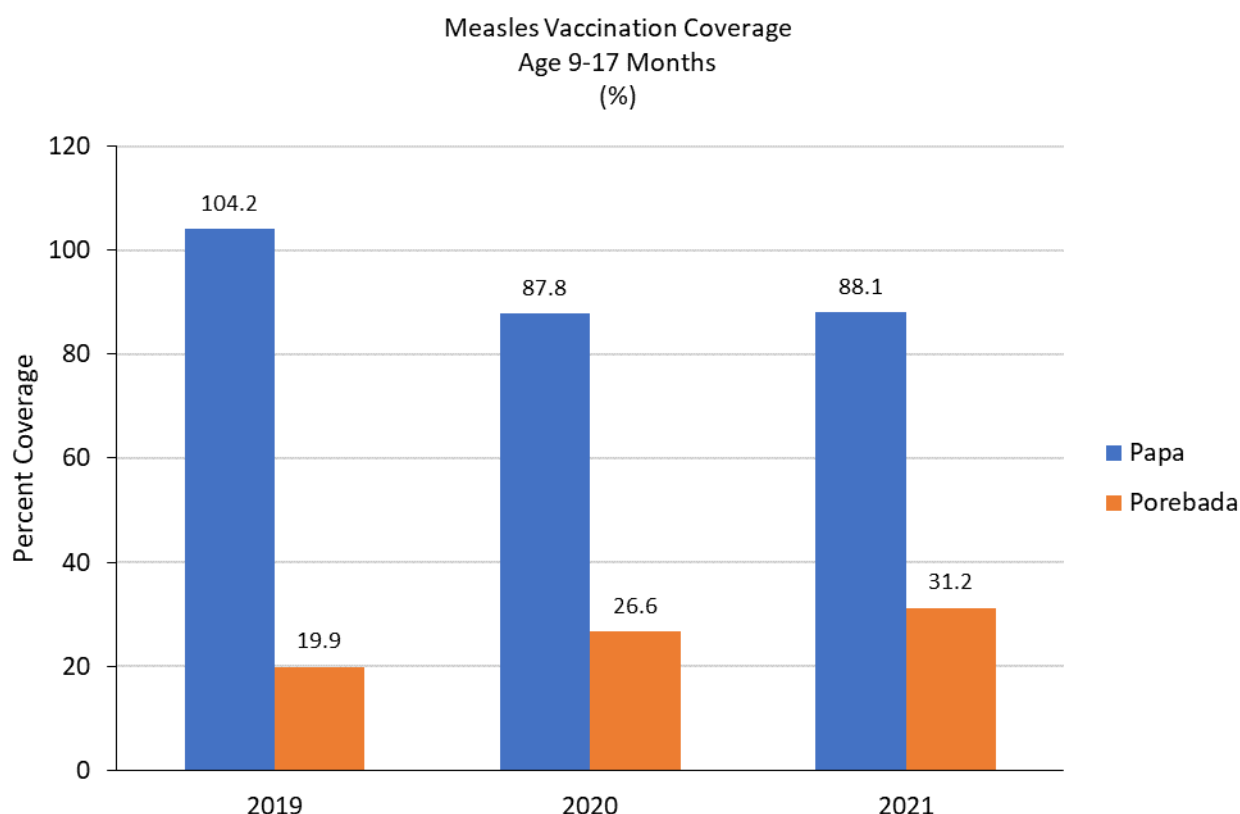
For children, measles, diphtheria, pertussis, and haemophilus influenzae type B are common and highly communicable respiratory diseases. NDOH has a measles vaccine and administration schedule where the first dose is given by 9 months and the second dose by 18 months. Similarly, diphtheria, pertussis, and haemophilus influenzae type B are common and highly communicable respiratory diseases. Diphtheria, pertussis, and haemophilus influenzae type B vaccines are combined with two non-respiratory vaccines (tetanus and hepatitis B) into a combination vaccination known as a “pentavalent” or 5-in-1 vaccine administered in three doses scheduled at 6, 10, and 14 weeks of age. The SPAR pentavalent output measure is the percentage of children under one year who have received all three doses. Figure 6-7 presents the pentavalent vaccination coverage for Papa and Porebada sub health centres.

**Figure 6-7. 2021 Pentavalent vaccination coverage Papa and Porebada sub health centres (three doses [%])**

Source: eNHIS 2019-2021

Measles is an example of a highly communicable respiratory illness that can have explosive outbreaks when community herd immunity is low. In late 2013 in the Hela Province, there was a large measles outbreak with more than 2,600 cases (Global Alliance for Vaccines and Immunization 2015). In response to this outbreak, there was a massive immunisation effort lead by Tari Hospital, Médecins Sans Frontières (MSF), and the Oil Search Foundation. Over 2,300 cases were treated, and 116,000 vaccinations were administered. Historically, measles vaccination levels in Papua New Guinea are low—2015 nationwide levels were less than 40% for 1-year olds. In addition, prior to 2016, Papua New Guinea was one of only three WHO Western Pacific Region countries that had not included measles-rubella vaccine in its routine immunisation schedule (Global Alliance for Vaccines and Immunization 2015). As shown in Table 6-23, 2021 measles vaccination rates for children 9–17 months were variable: Papa Sub Health Centre (88%), Porebada Sub Health Centre (31%), and Kairuku-Hiri District (49%). Papa and Porebada sub health centres' 2019–2021 measles vaccination coverage ages 9–17 months are presented in Figure 6-8.

**Figure 6-8. Measles vaccination coverage Papa and Porebada sub health centres 2019–2021**



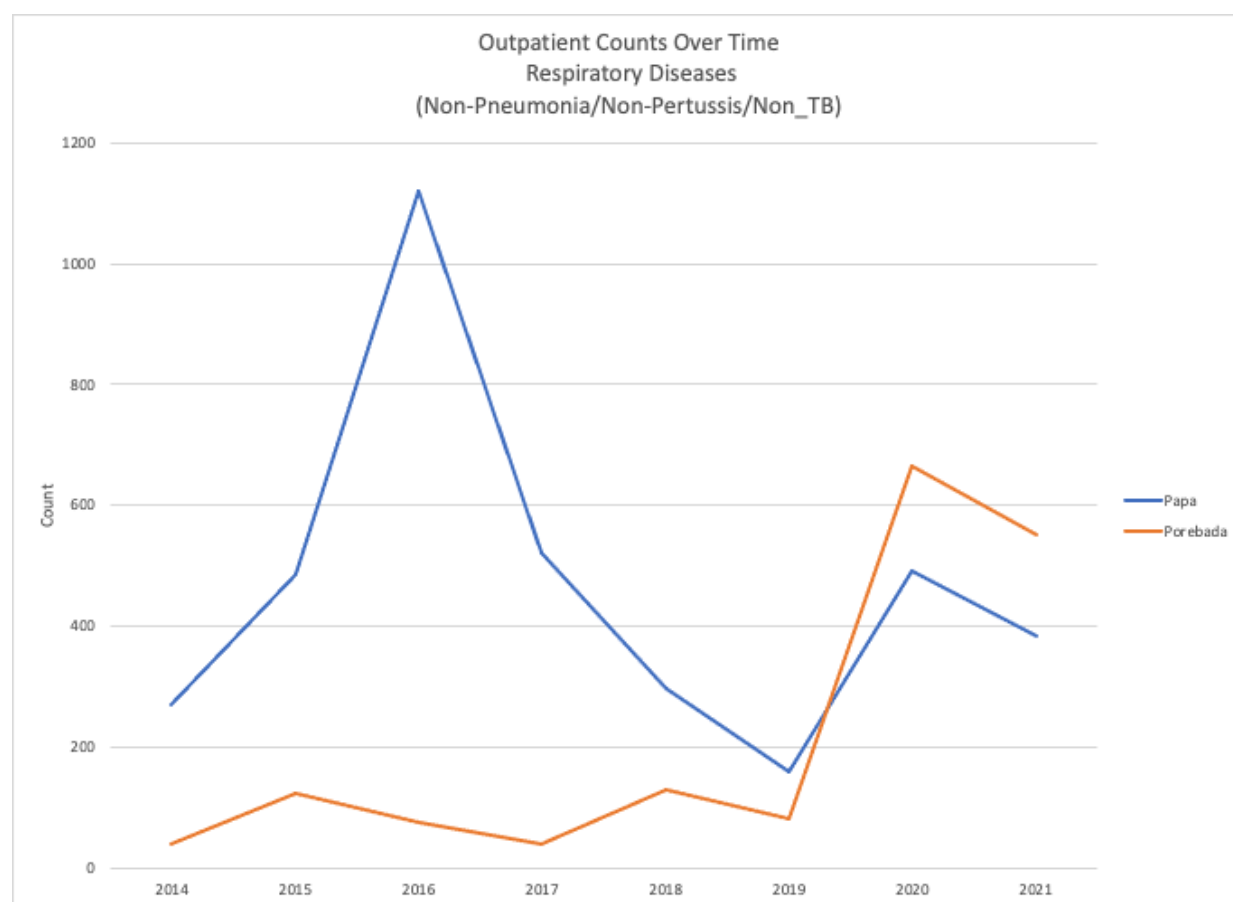
Source: eNHIS 2019-2021

As previously shown in Table 6-23, SPAR data only reports case fatality rate for pneumonia deaths for children under 5 years. However, eNHIS collects outpatient respiratory disease data across multiple diagnostic categories:

- Simple cough
- Pneumonia
- Chronic obstructive pulmonary disease
- Asthma
- Tuberculosis
- Pertussis
- “Other”

Figure 6-9 illustrates the non-pneumonia, non-tuberculosis, non-pertussis outpatient cases over the 2014–2021 time period. The eNHIS data were aggregated to match historic (pre-eNHIS) 2014–2018 Papa Sub Health Centre and Porebada Sub Health Centre data reporting categories.

**Figure 6-9. Outpatient cases (counts) 2014-2021 respiratory diseases**

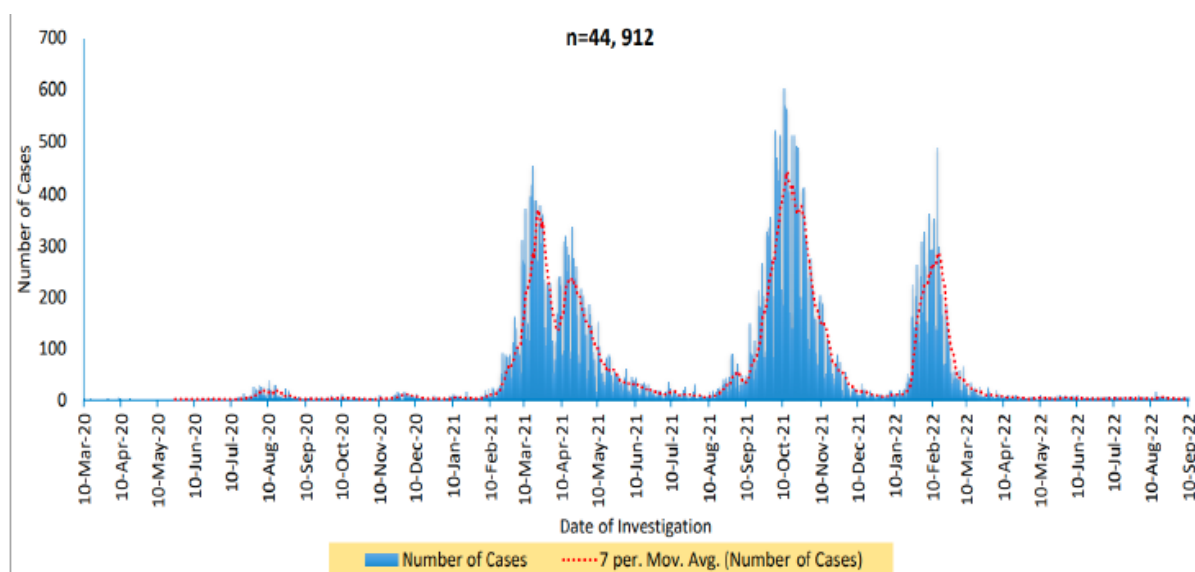


Source: eNHIS 2019–2021

### COVID-19 data

COVID-19 data are available through a series of NDOH-WHO Health Situation Reports. As of 28 November 2022, Papua New Guinea had officially reported a cumulative total of 45,819 confirmed cases of COVID-19, including 668 COVID-19 confirmed deaths (NDOH and WHO 2022a). As of 11 September 2022, the Central Province has reported 1,302 cumulative cases and 6 overall deaths. As shown in Figure 6-10, COVID-19 has impacted Papua New Guinea in three distinct waves (NDOH and WHO 2022a). At the LNG Plant Village level, discussions with ExxonMobil LNG Medicine and Occupational Health Department (personnel communication October 2022) confirm that the LNG Plant site also experienced a rise in suspect and confirmed COVID-19 cases during the March/April 2021, October 2021, and February 2022 time periods.

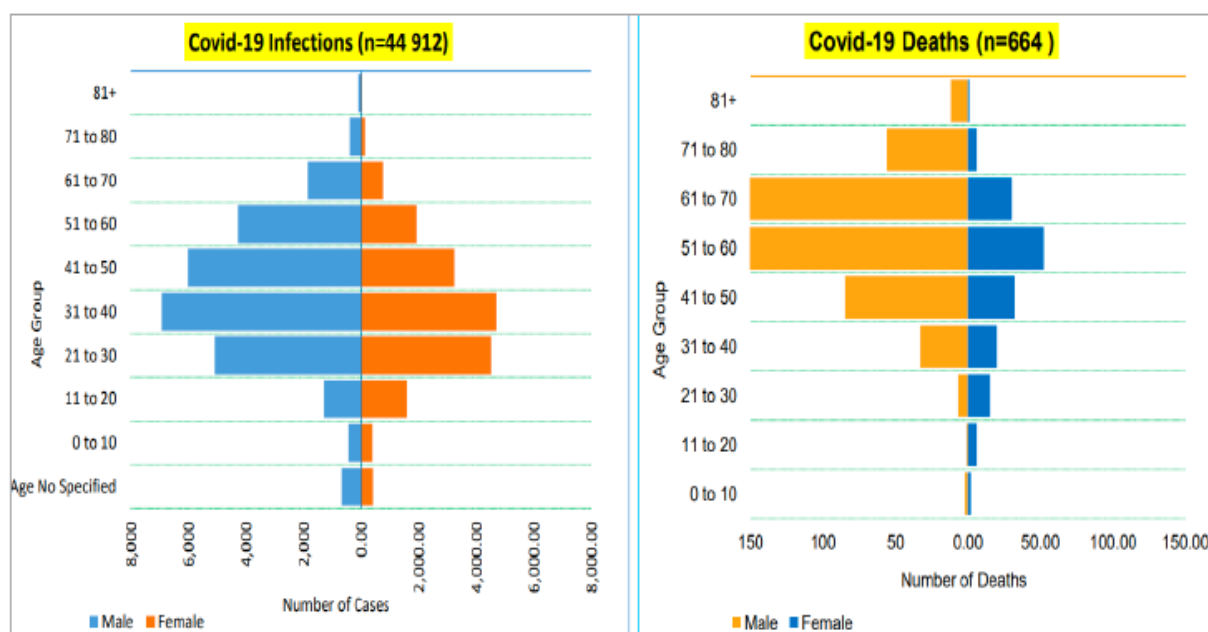
**Figure 6-10. Epidemiological curve of total COVID-19 cases in Papua New Guinea (11 September 2022)**



Source: NDOH and WHO 2022a

The overall national level age-sex profile of COVID-19 infection is shown in Figure 6-11.

**Figure 6-11. Cumulative COVID-19 infections and deaths by age and sex September 2022**



Source: NDOH and WHO 2022a

COVID-19 vaccination roll-out has occurred across all provinces. Eligibility for vaccination is open to all adults 18 years and older but with an emphasis on health care workers, adults over 45 years of age, and adults with comorbidity (NDOH and WHO 2022a). Table 6-30 presents COVID-19 vaccination accumulation coverage for the Central Province with comparison to National Capital District and national.

**Table 6-30. Papua New Guinea COVID-19 vaccination accumulation coverage (20 November 2022)**

|                           | 2022 Target | Cumulative at least one dose received (#) | At least one dose received (%) | Fully vaccinated (#) | Fully vaccinated coverage (%) |
|---------------------------|-------------|-------------------------------------------|--------------------------------|----------------------|-------------------------------|
| Central                   | 172,997     | 9,337                                     | 5                              | 6,773                | 4                             |
| National Capital District | 278,463     | 127,842                                   | 46                             | 117,340              | 42                            |
| National                  | 5,124,530   | 364,090                                   | 7                              | 303,884              | 6                             |

Source: NDOH and WHO 2022b

### Tuberculosis

Tuberculosis is a significant issue in Papua New Guinea and in some locations is at epidemic levels (Cross et al. 2014). The WHO defines an epidemic as: “The occurrence in a community or region of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy” (2008). According to WHO, tuberculosis kills more people in Papua New Guinea than any other infectious disease (WHO 2016a). A 2022 PNG IMR study (Pham et al. 2022) on tuberculosis and HIV/AIDS attributed mortality (from 2018–2020) indicated that tuberculosis accounted for 14% of the deaths at the PNG IMR Hiri (Papa and Porebada sub health centres) CHESS location. These results were based on verbal autopsy interviews.

In Papua New Guinea, only passive case finding of tuberculosis patients (as in, only those who present to health facilities are screened and diagnosed) is adopted. Consequently, the current estimates of tuberculosis prevalence are based exclusively on notification records of tuberculosis patients that visited health facilities and received treatments. Typically, active case finding surveys (actively screen and diagnose targeted populations or high-risk groups) have not been executed across Papua New Guinea; hence, the published rates are estimates based on a combination of passive reporting and mathematical modelling.

Tuberculosis is a complex disease to accurately diagnosis and manage, particularly in remote, rural settings. Papua New Guinea health professionals at both national and provincial levels are increasingly voicing concerns not only regarding the high countrywide prevalence of tuberculosis, but also regarding the rise of MDR-tuberculosis and extensively drug resistant tuberculosis (XDR-tuberculosis).

As defined by WHO, MDR-tuberculosis is a form of tuberculosis where the mycobacterium is resistant to at least two of the primary first-line treatment medications (isoniazid and rifampin) (WHO 2016a). XDR-tuberculosis is defined as tuberculosis that has developed resistance to at least two first-line treatment drugs (rifampicin and isoniazid) as well as to any member of the quinolone family of drugs and at least one of the second-line anti-tuberculosis injectable drugs. MDR-tuberculosis is difficult to treat, and in a resource limited setting, has a very poor prognosis. XDR-tuberculosis has a dismal prognosis and is not treated in Papua New Guinea (cases have been transferred to Australia). The available tuberculosis services, programs, clinical data, and service providers relevant for the LNG Plant villages are presented in detail.

Finally, exposure to pollutants from indoor combustion of solid fuels in open fires or in traditional stoves increases the risk of ALRI and associated mortality amongst young children. Across the LNG Plant villages, 88–95% report using wood as a cooking fuel source (2019 Tetra Tech Coffey Baseline Social Report). Indoor air pollution from solid fuel use is estimated to cause 36% of all lower

respiratory infections and 22% of chronic obstructive pulmonary disease (WHO 2002; WHO 2006). There are a few Papua New Guinea based studies of indoor air pollution and respiratory illness (Anderson 1978; 1979); however, these papers are based on communities in the Highlands Region.

## 6.6.2 Sources of information

This subsection discusses the sources of information used for EHA 2.

### Peer-reviewed published literature

Although this document is focused on the LNG Plant villages, there are longstanding trade and migration patterns from the Gulf Province to the LNG Plant villages, particularly Lea Lea. Hence, it is worth looking at the available and relevant tuberculosis data that could potentially impact the LNG Plant villages.

Cross et al. (2014) is the only peer-reviewed study of tuberculosis incidence and prevalence for the Gulf Province. This study prospectively collected data on 274 patients presenting to Kikori Hospital with a presumptive diagnosis of tuberculosis and on hospital in patients receiving tuberculosis treatment during the study period. Sputum was collected for microscopy, GeneXpert analysis, culture, and genotyping of isolates. The estimated incidence of tuberculosis in Kikori was 1,290 per 100,000 people (95% confidence interval: 1,140-1,460) in 2012. This estimated incidence rate is three times higher than the 2021 Papua New Guinea national rate reported to WHO (see Table 6-31).

**Table 6-31. Tuberculosis incidence rates**

| Location                   | Per 100,000 |
|----------------------------|-------------|
| Kikori - Papua New Guinea  | 1,290.0*    |
| Central Province           | 192.0**     |
| National Capital District  | 1,199.0**   |
| Papua New Guinea- National | 441.0***    |
| Australia                  | 6.5***      |

Sources: \*Cross et al. 2014; \*\*NDOH 2021; \*\*\*WHO 2021

The proportion of Kikori tuberculosis patients co-infected with HIV was 1.9% (Cross et al. 2014). In contrast to the high tuberculosis incidence rates reported in African countries (Chaisson and Martinson 2008), the rate in Kikori is unusual as it is not associated with a high frequency of HIV co-infection. The Kikori tuberculosis incidence rate is one of the highest non-HIV co-infection driven rates in the world. As noted by Cross et al., “our incidence figure may be an underestimate of the true incidence, as only patients presenting to the hospital were included in the study and we did not perform active case finding in the community villages” (2014, 6).

In 2014, Ley et al. published a historical review of tuberculosis studies in Papua New Guinea. This paper pointed out the issue of HIV co-infection and tuberculosis in urban settings, particularly POM. Key risk factors included malnutrition, smoking, and diabetes. Diabetes is known to double or triple the risk of tuberculosis, and its prevalence is increasing in Papua New Guinea (see EHA 7—NCDs). The impact of increasing alcohol consumption and betel nut chewing are potential risk factors; however, this has not been systematically studied in Papua New Guinea (Ley et al. 2014). LNG Plant Village data for betel nut and alcohol consumption are presented in subsequent sections. Tuberculosis drug resistance testing began in 2014; hence, there is limited historical data. The ability to test for drug resistance is improving in terms of laboratory capacity and testing.

The 2021 SPAR (2020 data) rate per 100,000 for the Central Province and National Capital District are shown in Table 6-31. Comparable rate per 100,000 data for the LNG Plant villages are not available. ExxonMobil LNG Medicine and Occupational Health Department onsite tuberculosis testing data for staff from the LNG Plant villages identified four new cases over the 2019–2021 time period (personal communication October 2022). There were 37 “suspect” eNHIS 2021 tuberculosis cases reported by Porebada Sub Health Centre and 65 suspect tuberculosis cases reported by Papa Sub Health Centre. These cases are clinically diagnosed and not laboratory confirmed. Table 6-33 presents the longitudinal case detection data for Papa and Porebada sub health centres. As previously noted, Pham et al. (2022) documented, via verbal autopsy interviews, a 14% tuberculosis cause of death rate in the LNG Plant villages.

In 2016, Aia et al. published a large population-based survey regarding the burden of drug resistant tuberculosis in Papua New Guinea. This study was conducted in four provinces: Madang, Morobe, National Capital District, and Western Province. MDR-tuberculosis was detected in 2.7% of cases (1.1 to 4.3% confidence interval). No cases of XDR-tuberculosis were detected. As noted by Aia et al, “a large proportion of MDR-TB cases were identified from a single hospital in Western Province, suggesting that the prevalence of MDR-TB across the country is heterogeneous” (2016, 1–2).

There has been a substantial focus on the Western Province, and several papers have been published that document high incidence rates and significant levels of MDR-tuberculosis (Aia et al. 2016; Simpson et al. 2011; Gilpin et al. 2008).

### **Papua New Guinea National Department of Health and National Tuberculosis Control Program**

The National Tuberculosis Control Program (NTP) functions within the overall umbrella of the NDOH. The NTP has issued a formal Papua New Guinea National Tuberculosis Management Protocol in 2011 (NDOH 2011b). The NTP has defined the main roles for the different levels of tuberculosis control at the national, provincial, and district levels. NTP has the following primary goals:

- Reduce the impact of tuberculosis as a public health problem.
- Increase the detection of sputum smear positive tuberculosis.
- Cover 100% of the country's population with directly observed treatment, short course (DOTS)<sup>7</sup>.

While the NTP sets objectives and strategies, implementation is primarily at the provincial and district level. As previously described in EHA 1—health systems, there is often a tremendous gap between the high-level articulation of strategies and its actual on-the-ground local-level implementation.

The most current national level tuberculosis data are in the 2018 SPAR report; however, these data were not consistently disaggregated at either the provincial or district level. The most current tuberculosis data for the LNG Plant villages is a September 2013–February 2014 PNG IMR study (PNG IMR March 2015 Report).

### **LNG Plant Village tuberculosis epidemiology**

From September 2013 to February 2014, under the sponsorship and support of the PiHP, PNG IMR executed an active case detection (ACD) cross-sectional epidemiologic survey of tuberculosis incidence and prevalence across the LNG Plant villages. In this study, the individual is the unit of

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<sup>7</sup> DOTS is the WHO-approved, internationally recognised strategy for tuberculosis control that includes five components: (1) political and financial commitment, (2) diagnosis by quality ensured sputum-smear microscopy, (3) standardised short-course treatment, (4) high-quality medications supply, and (5) standardised recording and reporting.

analysis as opposed to the household; therefore, the survey targeted the total population of the LNG Plant villages. A house-to-house survey (covering all ages) was launched to detect individuals with cough for more than 3 weeks or/and who identified themselves as suffering from tuberculosis. Three weeks of persistent cough is a standard WHO criterion for possible tuberculosis. Those individuals identified as tuberculosis patients and who were undergoing tuberculosis treatment were reviewed (using their health book) for their tuberculosis treatment. PNG IMR also crosschecked patient records in the tuberculosis registration at the local health facilities. Summary results of this study are shown in Table 6-32.

**Table 6-32. Papua New Guinea Institute of Medical Research LNG Plant Village tuberculosis study results (2014)**

| LNG Plant villages                                       | Population (N=13,310) |
|----------------------------------------------------------|-----------------------|
| Number of villages                                       | 4                     |
| Total population survey                                  | 13,310                |
| Cough for more than 3 weeks                              | 185                   |
| Sputum submitted                                         | 370                   |
| Tuberculosis diagnosed from this ACD survey*             | 16                    |
| Tuberculosis cases diagnosed by ISOS (PNG LNG workers)   | 18                    |
| Tuberculosis rate from ACD in 2013                       | 120/100,000           |
| Tuberculosis cases from Passive case finding in 2013     | 34                    |
| Tuberculosis rate from passive case detection in 2013    | 255/100,000           |
| Total new tuberculosis cases (ACD and passive detection) | 61                    |
| Incidence rate of tuberculosis in 2013                   | 458/100,000           |
| Total tuberculosis cases                                 | 68                    |
| Prevalence tuberculosis rate in 2013                     | 510/100,000           |
| Resistance to Rifampin positive from GeneXpert           | 4                     |

Source: PNG IMR 2015

The results of the PNG IMR study clearly documented that a substantial tuberculosis problem was present across the LNG Plant villages, and passive case finding alone was insufficient to characterise the magnitude of the burden of tuberculosis. In parallel to the ACD study, PNG IMR also performed a “tuberculosis knowledge, attitude, and practice” survey for the LNG Plant villages, Asaro, Hides, and Karkar sites. The LNG Plant villages had higher percentages of knowledge of tuberculosis causation (bacteria-79%), transmission (airborne-84%) and risk factors (living with tuberculosis patient-85%), and how to reduce transmission (cover mouth while coughing-61%) than those from the Asaro and Karkar sites. This level of “higher knowledge” was associated with the higher level of educational attainment observed in the LNG Plant villages versus the other locations. Nevertheless, less than 50% of LNG Plant villagers knew that crowded housing was a tuberculosis transmission risk factor (43%), HIV+ status was a risk factor (15%), and that Bacille Calmette-Guerin (BCG) vaccination could decrease tuberculosis risk (17%). In addition, a substantial number of respondents held the following misperceptions/misbeliefs: (1) tuberculosis transmission could occur with food sharing (41%), (2) inherited within the family (38%), and (3) skin contact transmission could occur.

The 2014 PNG IMR survey demonstrated that tuberculosis is a significant issue across the LNG Plant villages. The “knowledge, attitude, and practice” survey demonstrated that while there was a significant knowledge base across the communities there was obvious room for enhanced educational outreach.

**Longitudinal tuberculosis passive case detection data LNG Plant Village health facilities (2013–2018)**

Longitudinal tuberculosis passive case detection data were reviewed covering years 2013–2018. These data are collected by the Central Province Health Department and represent “suspect tuberculosis” cases that are registered within the health care system. Under current WHO reporting rules (WHO 2014b), a “suspect” case has been renamed as a “presumptive tuberculosis case” (a clinically diagnosed tuberculosis case). The formal WHO definition for a clinically diagnosed tuberculosis case is:

...one who does not fulfil the criteria for bacteriological confirmation but has been diagnosed with active TB by a clinician or other medical practitioner who has decided to give the patient a full course of TB treatment. This definition includes cases diagnosed on the basis of X-ray abnormalities or suggestive histology and extrapulmonary cases without laboratory confirmation. Clinically diagnosed cases subsequently found to be bacteriologically positive (before or after starting treatment) should be reclassified as bacteriologically confirmed.

Bacteriologically confirmed or clinically diagnosed cases of tuberculosis are also classified according to:

- Anatomical site of disease;
- History of previous treatment;
- Drug resistance; and
- HIV status.

Table 6-33 presents the recorded total “suspect tuberculosis” cases recorded by the Porebada and Papa health facilities from 2013–2021.

**Table 6-33. LNG Plant Village health facilities tuberculosis passive case detection data (2013–2021)**

| Year | Porebada Sub Health Centre | Papa Sub Health Centre |
|------|----------------------------|------------------------|
| 2013 | 10                         | 30                     |
| 2014 | 0                          | 31                     |
| 2015 | 33                         | 24                     |
| 2016 | 28                         | 40                     |
| 2017 | 3                          | 65                     |
| 2018 | 4                          | 33                     |
| 2019 | 16                         | 38                     |
| 2020 | 30                         | 60                     |
| 2021 | 37                         | 65                     |

Source: Central Province HMIS 2019-08-12

To fully understand the ongoing burden of tuberculosis across the LNG Plant villages, both active and passive case detection are required. The combination of both the PNG IMR study and the 2019-2021 tuberculosis caseload data indicates that tuberculosis is a significant health issue for the LNG Plant

villages. The concerns regarding tuberculosis expressed during the 2019 FGD and KIIs also reinforce the observation that tuberculosis is an ongoing critical health issue.

### Summary

- **Respiratory diseases (excluding tuberculosis and pertussis) are common outpatient diagnoses at both Papa Sub Health Centre and Porebada Sub Health Centre.**
- **Papua New Guinea has experienced three COVID-19 waves over 2021 and 2022 (to date).**
- **Central Province COVID-19 data are available; however, LNG Plant village COVID-19 disaggregated data are not available.**
- **Papua New Guinea tuberculosis rates per 100,000 are available at the provincial and national level but not for the LNG Plant villages.**
- **Tuberculosis case detection levels have increased for the Papa and Porebada sub health centres over the 2019–2021 time period.**

## 6.7 Environmental Health Area 3—vector-borne diseases

Historically, the primary VBDs relevant to the LNG Plant villages are malaria and the flaviviruses, such as dengue, Japanese Encephalitis, Zika, and Chikungunya. However, the only consistently diagnosed and reported VBD data are for malaria.

### 6.7.1 Overview

In Papua New Guinea, malaria has been the dominant VBD and has been studied for decades, primarily by PNG IMR in partnership with other international institutions (PNG IMR 2015). There are a substantial number of PNG IMR longitudinal studies that have documented the changes in malaria prevalence rates across Papua New Guinea (PNG IMR 2021; Hetzel et al. 2015; PNG IMR 2015; Maraga et al. 2011). There has, however, been unambiguous and substantial improvement in the malaria prevalence across the Central Province, particularly in the LNG Plant villages.

The national malaria control programme has reported important successes in recent years, including a 75% decline in malaria admissions since 2000 and a decline in parasite prevalence from 12.4 to 1.8% between 2009 and 2014 (Rosewell et al. 2017). These declines have been linked to the increased coverage of long-lasting insecticidal nets and the increased proportion of confirmed cases treated with artemisinin-based combination therapy (Rosewell et al. 2017). However, a critical consideration is the introduction and national rollout of RDTs that began in 2011. As discussed in the morbidity section (Section 6.3) of the Health Baseline report, the introduction of RDTs had an immediate impact on clinic reported statistics. As noted by Rosewell et al. (2017), fever patients were typically reported as “clinical malaria” through the National Health Information System (NHIS), despite the fact that approximately 15% were actually tested for malaria infection by RDT and only 3.6% tested by microscopy. Therefore, it is highly likely that “historic” malaria levels were overestimated.

The most current and objectively based national malaria surveys are performed and reported by PNG IMR in 2021 (2019–2020 survey) These surveys are sponsored by the Global Fund and used for programme monitoring and evaluation.

### Papua New Guinea Institute of Medical Research malaria indicator survey 2019–2020

As stated in the PNG IMR 2019–2020 malaria indicator survey (MIS), “After a resurgence of malaria prevalence observed between 2013/14 and 2016/17, this report documents a decrease between 2016/17 and 2019/20 across PNG. Simultaneously, trends in LLIN coverage show a reduction at national level compared to 2016/17 but not in communities in low-lying areas.” Summary data comparing the Central Province and National Capital District are shown in Table 6-34.

|                           | Percentage of household with at least one mosquito net | Percentage of the household with access to a <i>treated</i> mosquito net | Percentage of the household who slept under any mosquito net last night | Percentage of children <5 years who slept under a treated mosquito net last night | Percentage of children <5 years of age having malaria based on testing |
|---------------------------|--------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Central                   | 95                                                     | 87                                                                       | 77                                                                      | 82                                                                                | 0                                                                      |
| National Capital District | 55                                                     | 44                                                                       | 25                                                                      | 28                                                                                | 0                                                                      |
| Global Fund Target        | 85                                                     | 60                                                                       | 65                                                                      | 65                                                                                | NA                                                                     |

Source: PNG IMR 2021

### Bed net data

As part of the 2019 LNG Plant village health household survey, questions regarding bed net presence and use were asked. Table 6-35 and Table 6-36 present these survey results.

As shown in Table 6-35, there is extremely high penetration of bed nets across the LNG Plant village households and virtually all households have at least one insecticide-treated net (ITN). Similarly, utilisation is also high (see Table 6-36). Given the widespread distribution and utilisation of ITNs (see Table 6-37), it is not surprising that the actual level of objective malaria is extremely low across the LNG Plant villages.

**Table 6-35. Use of bed nets – quantity and treatment (2019)**

| Demographic              | Number of Surveyed Households | Number of Surveyed Households responding | Number of Households with at least one net | Percentage of households with mosquito nets for sleeping | Average number of nets per household | Percentage of households with 100% treated nets |
|--------------------------|-------------------------------|------------------------------------------|--------------------------------------------|----------------------------------------------------------|--------------------------------------|-------------------------------------------------|
| Boera                    | 92                            | 84                                       | 81                                         | 96%                                                      | 4                                    | 86%                                             |
| Lea Lea                  | 106                           | 104                                      | 104                                        | 100%                                                     | 5                                    | 79%                                             |
| Papa                     | 73                            | 71                                       | 71                                         | 100%                                                     | 5                                    | 97%                                             |
| Porebada                 | 149                           | 138                                      | 137                                        | 99%                                                      | 4                                    | 91%                                             |
| <b>Combined villages</b> | <b>420</b>                    | <b>397</b>                               | <b>393</b>                                 | <b>99%</b>                                               | <b>5</b>                             | <b>88%</b>                                      |

Note: Percentage of households treated nets is calculated by the number of nets either pre-treated or treated by the number of nets reported within the household

Table 6-36. Use of bed nets – sleeping (2019)

| Demographic              | Number of Surveyed Households responding | Percentage of households based on the percent of individuals sleeping under nets |          |           |          |          |          |           |              |
|--------------------------|------------------------------------------|----------------------------------------------------------------------------------|----------|-----------|----------|----------|----------|-----------|--------------|
|                          |                                          | 0%                                                                               | 1-20%    | 20-40%    | 40-60%   | 60-80%   | 80-99%   | 100%      | Un-specified |
| Boera                    | 84                                       | 6                                                                                | 1        | 14        | 11       | 7        | 2        | 46        | 12           |
| Lea Lea                  | 104                                      | 1                                                                                | 4        | 11        | 10       | 12       | 4        | 43        | 1            |
| Papa                     | 71                                       | 8                                                                                | --       | 3         | 4        | 6        | 6        | 73        | --           |
| Porebada                 | 138                                      | 1                                                                                | 5        | 11        | 10       | 9        | 7        | 29        | 14           |
| <b>Combined villages</b> | <b>397</b>                               | <b>1</b>                                                                         | <b>3</b> | <b>10</b> | <b>9</b> | <b>9</b> | <b>5</b> | <b>44</b> | <b>8</b>     |
|                          |                                          | <b>2</b>                                                                         |          |           |          |          |          |           |              |

Note: Percentage of individuals sleeping under nets is the reported number of individuals in the household sleeping under nets by the total number of individuals reported as living within the household.

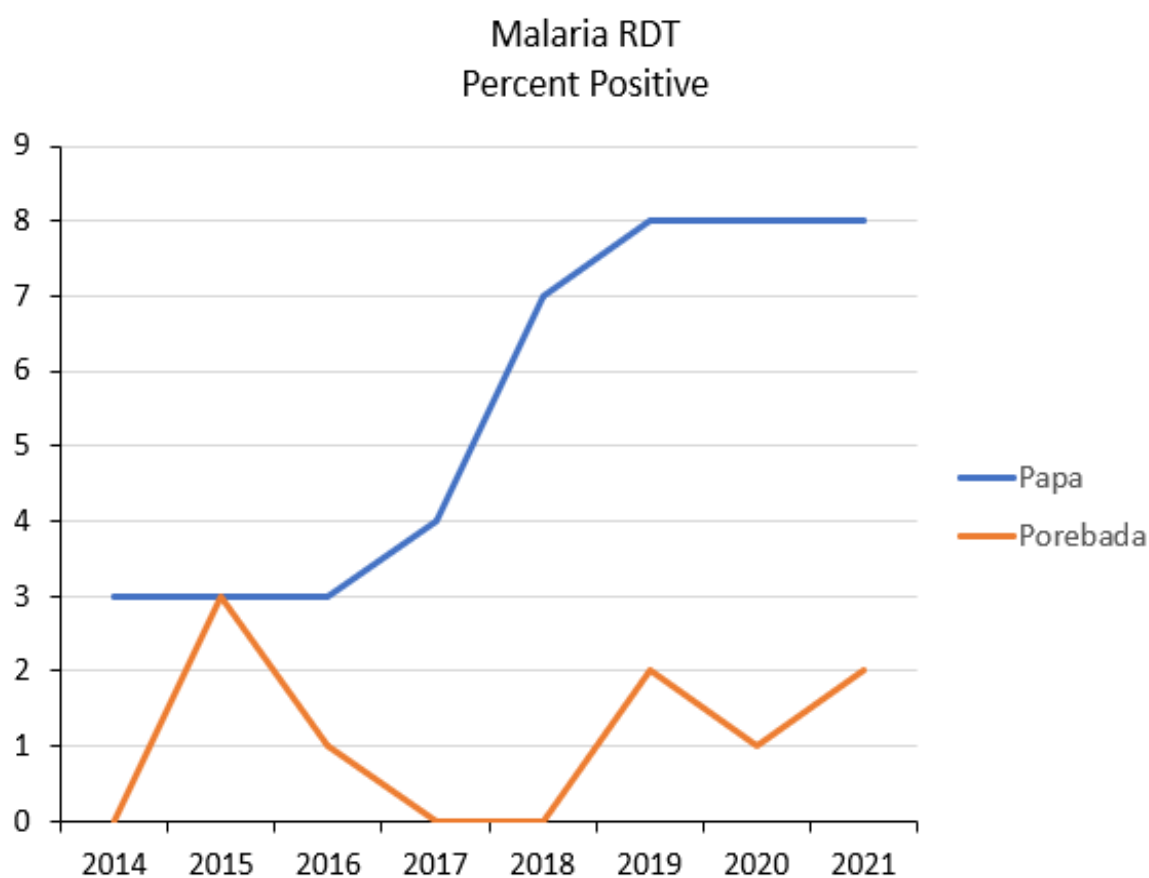
Table 6-37. Use of bed nets – source (2019)

| Demographic              | Top 5 reported known sources for nets                                                                          |
|--------------------------|----------------------------------------------------------------------------------------------------------------|
| Boera                    | Boera Aid Post, Global Fund, Health Department, World Vision, RAM                                              |
| Lea Lea                  | RAM, Papa Sub Health Centre, Health Department, Global Fund, family donation                                   |
| Papa                     | RAM, Health Department, IMR, EMPNG, Global Fund                                                                |
| Porebada                 | Porebada Aid Post, RAM, Global Fund, Health Department, self-purchase                                          |
| <b>Combined villages</b> | <b>RAM, Health Department, Global Fund, Papa Sub Health Centre, Porebada Sub Health Centre, Boera Aid Post</b> |

### LNG Plant village malaria test data

Longitudinal (2014–2021) malaria rapid test data (percentage positive) are shown in Figure 6-12 for the Porebada and Papa sub health centres. The 2019–2021 data are sourced from eNHIS. The eNHIS data do not indicate whether the positive case is a visitor from outside the four Hiri villages. Discussions with health facility personnel indicate that “visitor malaria” is, however, extremely common particularly at the Papa Sub Health Centre where there is a strong interaction between Lea Lea and the Gulf Province, an area that typically has a higher level of test positive malaria (3% children under age 5 based on the 2021 PNG IMR MIS).

Figure 6-12. Longitudinal malaria percent positive test data



Source: Clinic monthly report 2014–2018; eNHIS 2019–2021

### Summary

- LNG Plant village bed net distribution programme has been a success—88% for the LNG Plant villages.
- Malaria test data at the LNG Plant villages does show positive cases; however, many of these cases may be “visitor malaria” and not local residents.
- Viral VBDs, such as dengue, Zika, and Chikungunya, are uncharacterised and the underlying potential burden of disease is unknown.
- None of the local clinics have dengue fever test kits.

## 6.8 Environmental Health Area 4—sexually transmitted infections

STIs are a critical issue for large infrastructure projects that have substantial and geographically widespread construction phases. There is noteworthy concern and focus on HIV transmission resulting from project-related induced in-migration, large-scale movement of workers across previously remote areas, and sudden increases in disposable incomes that can increase drug use (alcohol and cannabis) and transactional sexual activity.

### 6.8.1 Overview

Papua New Guinea has among the highest prevalence of HIV, syphilis, and other STIs in the Asia-Pacific region (Vallely et al. 2016; Vallely et al. 2010). The HIV epidemic is primarily linked to heterosexual transmission, with over half of reported HIV diagnoses coming from three of its 22 provinces (Vallely et al. 2016; Vallely et al. 2010). Adult HIV prevalence is currently estimated at 0.9%; however, prevalence of 12–17% has been reported among women and men who sell and/or exchange sex, and antenatal HIV prevalence around 2% has been reported from several Highland provinces. Papua New Guinea is among 12 high-burden countries selected by the WHO for intensified support to eliminate mother to child syphilis transmission. Papua New Guinea also has one of the highest estimated burdens of cervical cancer globally, with an age-standardised incidence of 23.7 per 100,000, compared to 5.0 per 100,000 in Australia. Cervical cancer is considered an STI caused by specific strains of the HPV (Centers for Disease Control [CDC] 2017).

STIs are associated with significant adverse reproductive health outcomes, particularly among women. Genital ulcers can occur in the vagina and may not be easily visible, while men may be more likely to notice sores on their penis. Social and economic dependency may limit a woman's ability to refuse unsafe sex or negotiate safer sex. STIs in women tend to go untreated because they are often asymptomatic. In pregnant women with untreated early syphilis, 25% of pregnancies result in stillbirth and 14% in neonatal death (Vallely et al. 2016; Vallely et al. 2010). Up to 35% of pregnancies among women with untreated gonococcal infection are estimated to result in spontaneous abortion and premature deliveries, and up to 10% in perinatal death (Vallely et al. 2016; Vallely et al. 2010). In the absence of prophylaxis, 30–50% of infants born to mothers with untreated gonorrhoea and up to 30% of infants born to mothers with untreated chlamydia will develop *ophthalmia neonatorum*, which can lead to blindness if not diagnosed and treated promptly.

Untreated chlamydia or gonorrhoea can result in chronic salpingitis, leading to infertility or ectopic pregnancy. Infection with certain high-risk sub-types of HPV is associated with cervical epithelia dysplasia and cancer of the cervix, particularly types 16 and 18, while HPV-6 and HPV-11 cause genital warts. In addition to their direct effects on reproductive health, many STIs have been shown to biologically enhance the transmission and acquisition of HIV, so that their effective management may play an important role in HIV prevention, particularly in resource-limited settings (Vallely et al. 2016; Vallely et al. 2010). Herpes simplex virus (HSV)-2 is the virus that causes genital herpes. HSV-1 causes cold sores or fever blisters, primarily around the mouth.

### 6.8.2 Sources of information

This subsection discusses the sources of information used for EHA 4.

#### Peer-reviewed published literature

There are a variety of peer reviewed STI studies that consider the national level STI situation in Papua New Guinea (Vallely et al. 2016; Vallely et al. 2010). High prevalence rates of HIV, STIs, and genital infections have been reported among men and women in Papua New Guinea compared to other countries in the Asia-Pacific region. A recent systematic review and meta-analysis of HIV/STI prevalence in community and clinic-based settings in Papua New Guinea has been published (Vallely et al. 2016; Vallely et al. 2010; PNG IMR 2015) (see Table 6-38). There were no HPV or HSV-2 data

available for Papua New Guinea until the 2013/2014 PNG LNG Project-sponsored study performed by PNG IMR (Dr. Andrew Vallely, Lead Investigator) (PNG IMR 2015).

**Table 6-38. Summary of published data on antenatal HIV/sexually transmitted infection prevalence among pregnant women in Papua New Guinea<sup>1</sup>**

| Study population      | 206 Pregnant women attending first antenatal clinic visit at Port Moresby General Hospital | 155 Women presenting in labour to Goroka Base Hospital <sup>2</sup> | 581 Women presenting in labour to Goroka Base Hospital <sup>3</sup> |
|-----------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
| STI Agent             |                                                                                            |                                                                     |                                                                     |
| Bacterial vaginosis*  | 23.3 (17.7, 29.7)                                                                          | N/A                                                                 | N/A                                                                 |
| <i>C. trachomatis</i> | 17.7 (12.4, 24.0)                                                                          | 36.8 (29.2, 44.9)                                                   | 34.1 (30.2, 38.1)                                                   |
| <i>N. gonorrhoeae</i> | N/A                                                                                        | N/A                                                                 | N/A                                                                 |
| Syphilis              | N/A                                                                                        | N/A                                                                 | N/A                                                                 |
| <i>T. vaginalis</i>   | 18.9 (13.8, 25.0)                                                                          | N/A                                                                 | N/A                                                                 |
| HIV                   | N/A                                                                                        | N/A                                                                 | N/A                                                                 |
| HSV-2                 | N/A                                                                                        | N/A                                                                 | N/A                                                                 |

Source: Vallely et al. 2010

\* BV is not an STI per se, but it can increase a risk of getting an STI such as Chlamydia, hence it is shown by Vallely, 2010 (Figure 5).

<sup>1</sup>Data shown as percentage with 95% confidence intervals; N/A Not Available from published studies assessed by Vallely, 2010.

<sup>2</sup>1997 study by Mgone et al.

<sup>3</sup>1999 study by Suarkia et al.

The epidemiology of HIV and STIs in Papua New Guinea is complex and likely to be the result of locally specific interactions between the behavioural determinants, socio-cultural dimensions, and structural contexts that frame sexual agency, sexuality, and sexual health (Vallely et al. 2016). These include gender power disparities, sexual violence, and the societal roles of men and women; low levels of male and female condom use and male circumcision; limited access to STI treatment services due to poor transportation and health systems infrastructure; and limited success in the design and implementation of culturally-relevant behaviour change interventions among both general population and at-risk groups, such as truck drivers and male and female sex workers and their clients.

### Human papillomavirus and cervical cancer in Papua New Guinea

Papua New Guinea has one of the highest rates of cervical cancer in the world, with an estimated age-standardised incidence of 23.7 per 100,000 compared to 5.0 per 100,000 in Australia and New Zealand (Vallely et al. 2016; Vallely et al. 2010). Cervical cancer is the most common cancer and a leading cause of premature death among women in Papua New Guinea. An estimated 1,500 women die every year in Papua New Guinea due to cervical cancer. The PNG IMR has now published initial findings regarding HPV prevalence in Papua New Guinea (Vallely et al. 2016). Prior to the 2013/2014 PNG IMR study, there were no prevalence estimates of HSV-2 or HPV (Vallely et al. 2016; PNG IMR 2015). Levels of HPV and HSV were 43% and 28%, respectively, in a study of 765 pregnant women across three sentinel surveillance sites (Hiri, Hides, and Asaro) (PNG IMR 2015).

### National Department of Health data

This section discusses the data collected from the NDOH.

### Survey of sex workers

An integrated bio-behavioural survey of women and girls who sell and exchange sex (female sex workers [FSWs]), and men who have sex with men and transgender women (MSM/TG) was conducted in POM during 2016 to support the upscale of essential HIV prevention and treatment services for these populations. Of the 674 women and girls involved in sex work, the median age was 27 years (Kelly-Hanku et al. 2017). Half of the FSWs in POM originate from the Highlands regions and more than half FSWs have been residing in POM for more than 15 years (58.2%).

Almost one-third (30%) could not read or write and only 12.5% completed high school. Most FSWs were separated or divorced (61.4%), 18.4% were never married, and 13.2% were currently married. Sex work was the primary income source for 66.4% of FSWs, with over half (56.3%) earning less than 500 Kina (US\$147) per month. It is estimated there are 16,053 FSWs in POM.

Most FSWs (63%) did not use condoms during their last sexual encounter. HIV prevalence among FSWs in POM was 14.9% (NDOH 2017). At least 52.1% had at least one STI (excluding HIV). Almost one in ten had hepatitis B, and 2.2% of FSWs screened for tuberculosis were positive.

Of the MSM/TG, 400 participated in the study with a median age of 27 years. Approximately half had been residing in POM for more than 20 years. Approximately 12% could not read or write and 28.7% had completed high school. It is estimated there are 7,487 MSM and TG in POM. Less than one-third of these men and TG used a condom the last time they had sex. More than half have experienced physical violence and 24.1% have been forced to have sex. HIV prevalence among MSM and TG in POM was 8.5%.

These are important data, since according to health discussions conducted in the LNG Plant villages, in addition to local women who sell sex for income; other sex workers who provide services for men from the LNG Plant villages “come from” the POM area.

### National Department of Health sexually transmitted infection surveys

The NDOH conducts periodic syphilis and HIV sero-surveys to support routine antenatal surveillance. In 2009, estimated antenatal syphilis prevalence was 6.9% and HIV prevalence 0.7% in urban areas (N=4,623), and 4.2% and 0.5%, respectively, in rural areas (N=3,180) (Vallely et al. 2010).

The Joint UN Program on HIV/AIDS (UNAIDS) 2020 Papua New Guinea national prevalence rate is reported as 1.1% for women aged 15-49 and 0.7% for men aged 15-49. The 2021 SPAR report (2016–2020 data) presents Papua New Guinea national antenatal HIV prevalence by age (see Table 6-39).

Over 2019–2021, eNHIS ANC HIV (female) data for the Papa and Porebada sub health centres reported an overall 3% and 1.8% positive test rate respectively. During this 3-year time period, Papa Sub Health Centre performed 383 tests while Porebada performed 110 tests in women seen at their respective ANC clinics.

**Table 6-39. 2021 SPAR HIV national sero-surveillance antenatal clinic data (2016-2020)**

|      | 15-19 year old % + | 20-24 year old % + | Total 15-24 year old % + |
|------|--------------------|--------------------|--------------------------|
| 2016 | 1                  | 1                  | 1                        |
| 2017 | 1                  | 0.9                | 1                        |
| 2018 | 1                  | 1                  | 1                        |
| 2019 | 0.9                | 0.9                | 0.9                      |
| 2020 | 1                  | 1                  | 1                        |

Source: NDOH 2021

### Diagnosis of sexually transmitted infections in the LNG Plant villages

The appropriate testing capacity, skills, equipment, and supplies for accurately diagnosing STIs at aid posts (that are staffed) in the Project area are, for the most part, unavailable. The diagnosis and treatment of STIs is determined purely on symptoms presented by the patient. STI diagnoses are kept sensitive and are subject to medical confidentiality rules. The only voluntary counselling testing centre in the Project area is at Papa Sub Health Centre.

The diagnosis of STIs in Papua New Guinea aid posts is uncommon. STIs as a diagnosis rarely are greater than 1–2% of the total aid post caseload. Outpatient data from the LNG Plant health centres consistently show small percentages of STIs. This is not surprising due to the cultural stigma associated with an STI diagnosis. The 2019–2021 eNHIS data for Papa and Porebada sub health centres show 0-3 reported cases per year of “genital ulcers and warts.” Vaginal discharge and urethral discharge are more frequently reported (see Table 6-40).

**Table 6-40. STIs reported at Papa and Porebada sub health centres**

|      | <b>Vaginal Discharge (# cases) Papa Sub Health Centre</b> | <b>Urethral Discharge (# cases) Papa Sub Health Centre</b> | <b>Vaginal Discharge (# cases) Porebada Sub Health Centre</b> | <b>Urethral Discharge (# cases) Porebada Sub Health Centre</b> |
|------|-----------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------|
| 2019 | 19                                                        | 10                                                         | 0                                                             | 4                                                              |
| 2020 | 13                                                        | 8                                                          | 6                                                             | 1                                                              |
| 2021 | 15                                                        | 13                                                         | 0                                                             | 0                                                              |

Source: 2019–2021 eNHIS data

The 2019–2021 eNHIS are clinical diagnoses without any laboratory confirmation. The 2013/14 ‘Healthy Pregnancy Study’ conducted by PNG IMR provides the most detailed STI data for the LNG Plant villages. These data were obtained through antenatal clinics (n=225) at both Porebada and Papa sub health centres with the following key findings:

- Chlamydia: 23.8%
- Gonorrhoea: 25%
- Trichomonas: 32.7%
- HSV-2: 20.5%
- Syphilis: 0.5%
- HPV types 16 and 18: 10%
- HIV: 1.6%

Notwithstanding the small numbers of vaginal and urethral discharge cases reported over the 2019–2021 time period, the 2013/14 PNG IMR data indicates that there is a significant underlying burden of STIs across the LNG Plant villages that is not diagnosed at local health facilities.

### **Community health discussions**

Based on community health discussions and KIIs, communities are clearly concerned about STIs; however, local sexual networks, behaviours, and practices are unknown. The objective database indicates that there is likely an extremely large burden of undiagnosed non-HIV STIs present across local communities.

### Summary

- Based on SPAR national ANC data (females), HIV prevalence during 2016–2020 has remained at 1%.
- During 2019–2021, Papa and Porebada sub health centres reported a 3% and 1.8% HIV positive rate, respectively, for women seen at their ANCs
- The burden of non-HIV STIs in the LNG Plant villages is not known.
- Local clinic capability to assess and diagnosis STIs is based on clinical presentation as no laboratory confirmation testing is available.

## 6.9 Environmental Health Area 5—water- and sanitation-related diseases

This EHA considers diseases and conditions that are related to quantity and quality of water used by households, such as diarrhoeal diseases. Access to water is an important consideration. Personal hygiene, such as hand washing behaviours and access and use of soap, are also considered. General community sanitation is evaluated, particularly related to contact with non-hazardous wastes and soils.

### 6.9.1 Overview

In Papua New Guinea, there is a marked disparity between urban and rural populations in terms of access to a safe water supply and adequate sanitation (WHO 2011a; Prüss-Üstün et al. 2008; DHS 2019). For example, based on the 2016-2018 DHS, only 42% of rural households have an improved source of drinking water and 26% have improved sanitation facilities. In contrast, urban populations are at 83% and 60% respectively for the same categories. Related risk factors are also an important source of sudden disease outbreaks: interaction with fecally contaminated environmental sources, such as local drinking supply; swimming and washing in rivers; and ingesting fecally contaminated fresh produce.

Diseases related to unsafe water, poor sanitation, and lack of hygiene are some of the most common causes of infectious disease epidemics like cholera. It is estimated that improved water-sanitation and hygiene (WASH) could prevent at least 9.1% of the global disease burden (WHO 2011b; Prüss-Üstün et al. 2008).

Approximately 80% of the Papua New Guinea population is without access to improved sanitation (WHO 2013; DHS 2019); however, United Nations International Children's Emergency Fund (UNICEF) suggests that better access is occurring, estimating that “only” 55% of the population lack access to sanitation (UNICEF 2016). These data are contradicted by the 2016–2018 DHS study which found that the overall national level of access to improved sanitation was only 29%. Overall access to WASH generally remains poor, and that according to WHO, there has been little improvement in the past 25 years (WHO 2013).

### 6.9.2 Sources of information

This subsection discusses the sources of information used for EHA 5.

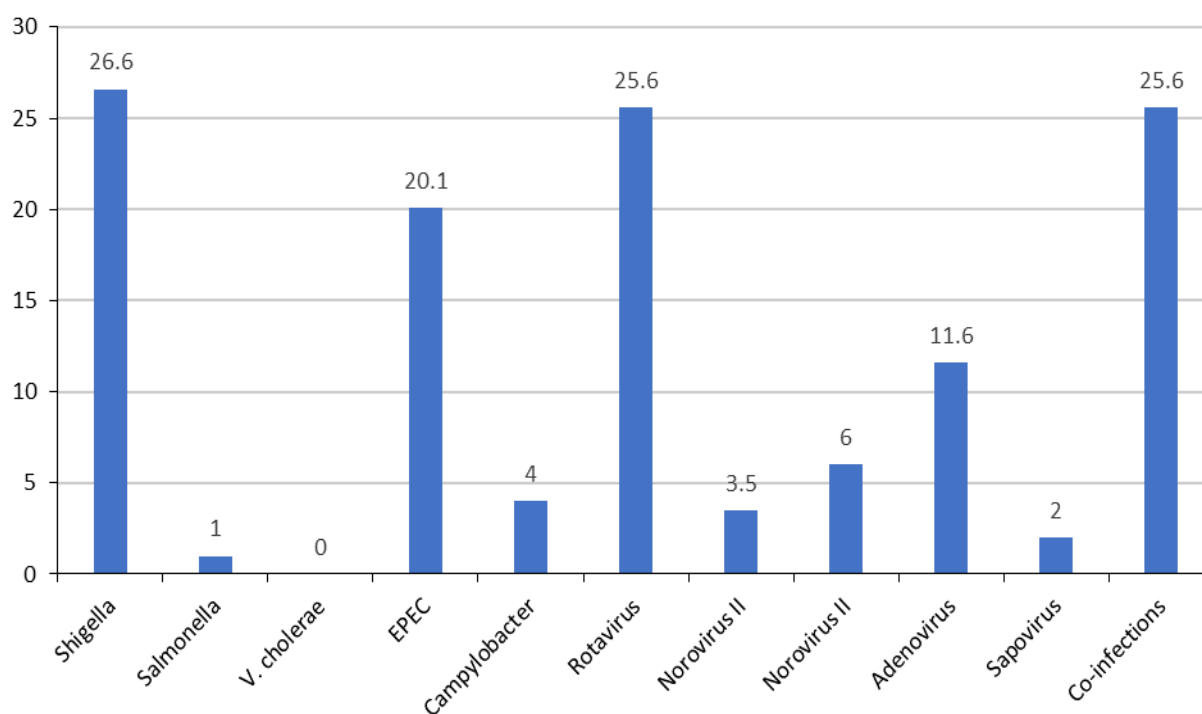
## Relevant datasets

In Papua New Guinea, diarrhoeal disease is one of the leading causes of morbidity and mortality, accounting for 8% of deaths among children under age 5 (WHO 2013).

PNG IMR (2016) investigated the causal agent of acute watery diarrhoea for 199 children admitted to Goroka General Hospital (see Figure 6-13). An intestinal pathogen was detected in 67.8% (n=135) of the samples tested. *Shigella* spp. (26.6%), rotavirus (25.6%), enteropathogenic *Escherichia coli* (20.1%), and enteric adenovirus (11.6%) were the pathogens most commonly detected. All other pathogens were detected at varying rates below 10%. Mixed infections were detected in 25.6% of diarrhoeal cases, with rotavirus (n=26) and *Shigella* spp. (n=25) the most commonly detected in co-infections. A similar profile was also observed in a PNG IMR study in the LNG Plant villages over the 2013/2014 time period (PNG IMR 2015):

- Hiri (53 samples):
  - *Shigella* and *campylobacter* spp. (during October 2013–April 2014 period)
  - Rotavirus and norovirus G2 (during mid 2014 period)
  - *Shigella*, *campylobacter* spp., and norovirus were dominant in most co-infections

**Figure 6.13. Causative agents of paediatric acute watery diarrhoea at Goroka General Hospital**



Source: PNG IMR 2016

Some of these diseases will vary, depending upon animal husbandry practices. If there are pigs close to living areas, there will be more *campylobacter*; if chickens are close, salmonella and *Shigella* spp. For the LNG Plant villages, chickens are far more common than pigs.

The PNG IMR studies (2015, 2016) indicate that personal hygiene, particularly hand washing is a key issue/concern as rotavirus is ubiquitously present. Rotavirus spreads easily among infants and young

children. People who are infected with rotavirus shed the virus in their stool. Infected individuals can spread rotavirus to family members and other people with whom they have close contact.

A specific hand washing study was completed by PNG IMR (September 2015) subsequent to the overall febrile illness. In this study, the proportion of households having both water and soap for hand washing was highest in the LNG Plant villages at 92%.

Improvement in the installation of community hand washing stations was part of the NGO (PSI) outreach effort and the presence of these stations doubled across the LNG Plant villages between 2013 and 2015. Similarly, over 10,000 WASH kits (Aquatabs, zinc, oral rehydration solutions, water bucket with tap, soap) were distributed and WASH interpersonal communication sessions were conducted for over 12,000 individuals across Hiri and Hides. Additionally, community led total sanitation WASH programmes were conducted with over 3,400 households. Community based “Helti Men/Helti Meris” were trained in early recognition of WASH related diseases to enhance early diagnosis and treatment. It is likely that NGO efforts provide initial benefit; however, it is uncertain how persistent the positive impacts actually are.

In Papua New Guinea, the burden of enteric illness is not restricted to children. Outbreaks of cholera and shigellosis in the past highlight the risk to the broader population of enteric disease outbreaks (Rosewell et al. 2011; Horwood et al. 2011); and endemic illnesses such as typhoid fever continue to cause illness (Siba et al. 2012). LNG Plant coastal communities are potentially at risk from a cholera outbreak, particularly considering the community sanitation practices.

The cholera outbreak is of interest because cholera had not been reported in Papua New Guinea prior to 2009. In 2009, a cholera outbreak spread along the northern coast of Papua New Guinea and resulted in over 15,500 cases and approximately 500 deaths, with a case fatality rate of 3.2% (Horwood et al. 2011). It has been hypothesised that the lack of sanitation and hygiene in Papua New Guinea was key to its spread throughout the country (Horwood and Greenhill 2012). Changing climate conditions and rainfall variability could be important future issues and drive water-related disease outbreaks.

### Central Province and LNG Plant Village health facility data

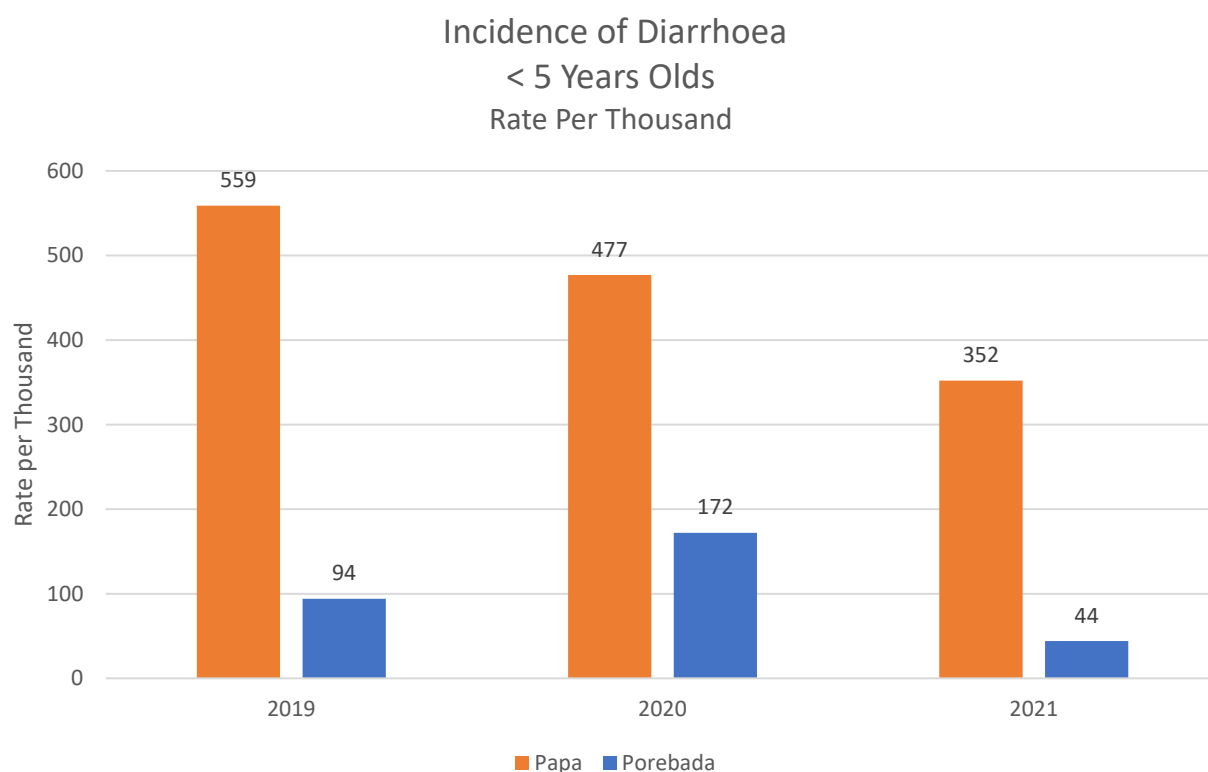
Diarrhoeal disease is an important cause of outpatient morbidity both in the Central Province as a whole and for the LNG Plant villages. As noted in the morbidity section, diarrhoea is a common outpatient diagnosis for all Central Province health facilities. The 2021 eNHIS diarrhoeal disease incidence rates in children <5 years per 1,000 children <5 years are shown in Table 6-41. The 2020 SPAR data for the National Capital District and overall Papua New Guinea national data are shown for further comparison. Figure 6-14 shows the 2019–2021 reported diarrhoeal disease incidence data for Papa and Porebada sub health centres.

**Table 6-41. 2021 Diarrhoeal disease data (eNHIS)**

| Indicator                                                                     | Central Province | Kairuku-Hiri District | Porebada Sub Health Centre | Papa Sub Health Centre | 2020 National Capital District | 202 Papua New Guinea National |
|-------------------------------------------------------------------------------|------------------|-----------------------|----------------------------|------------------------|--------------------------------|-------------------------------|
| Diarrhoeal disease incidence in children <5 years per 1,000 children <5 years | 130              | 169                   | 44                         | 352                    | 238                            | 178                           |

Source: eNHIS and NDOH 2021

**Figure 6.14. 2019–2021 Diarrhoeal disease incidence data Papa and Porebada sub health centres**



Source: eNHIS

### Project baseline reports

The Tetra Tech Coffey 2018/19 Field Survey Report contains water and sanitation (WATSAN) household survey information. According to this report, villages within the study area primarily rely on piped supply taps, rainwater tanks, and tube wells as water sources. Across the study area villages, between 47% (Lea Lea) and 83% (Papa) of people indicated that they had access to water throughout the year.

The following key water supply infrastructure findings are relevant for health:

- Porebada Village primarily relies on two water sources—one pump to supply tank and one spring. Both have poor quality and reliability. Local residents reported that the pump system is only used for washing due to the poor quality.
- Two tube wells located in central Boera were observed to be the primary water sources; however, additional private sources may also be present. The tube wells are poorly maintained and reliable for 50% of the year. Water quality is reported to be poor, requiring filtering and/or treatment before use.

- Papa Village water sources include piped supply taps, tube wells, and rainwater tank supply. Most water sources (90%) were reported to be well maintained, reliable, and of good quality. The tube well located in the north of the village supplies most of the village, with approximately 60 households drawing from it twice a day as a primary water source.
- Lea Lea Village relies primarily on piped water from the Taba River and two water tanks in the north. Approximately 80% of water sources are reported to be of good quality; however, some pipes and/or taps are not well maintained and result in residents complaining that the water has poor taste and quality.

**Plate 7. Latrine behind the Boera Aid Post - used by the community**



### Community surveys

Community health discussions raised water supply and water quality concerns. For example, women in Lea Lea stated, “We use the river as the toilet, then drink the water.” In addition, during KIIs, health care workers expressed concerns regarding water access and supply for health care facilities, especially in Boera, where the health facility water tank “runs dry” in the dry season and leaks in the rainy season.

### Household surveys

The household survey addressed water quality issues by asking whether anyone in the household has been ill with diarrhoea within the 2 weeks prior to the survey. These data were presented in the morbidity section and indicate that diarrhoea complaints, while common, are far less symptomatically prevalent than fever and cough. The reported household diarrhoea percentage is consistent with the health centre data.

Hygiene and sanitation were also asked in the household survey. These results are shown in Table 6-42.

**Table 6-42. What type of toilet do you have at your house?**

| Type of toilet                  | Porebada | Boera | Papa | Lea Lea |
|---------------------------------|----------|-------|------|---------|
| Communal                        | 3%       | 3%    | 10%  | 14%     |
| Ventilated improved pit latrine | 0%       | 2%    | 3%   | 1%      |
| Open pit                        | 32%      | 64%   | 66%  | 33%     |
| Mangrove/sea                    | 61%      | 21%   | 13%  | 45%     |
| Septic tank                     | 0%       | 4%    | 1%   | 3%      |

Source: Tetra Tech Coffey LNG Plant Social Baseline 2019

Toilet facility data indicate that there are low/modest levels of household sanitation as the ventilated improved pit percentage is only 1 to 3%.

### Summary

- **Reported 2021 diarrhoeal disease incidence data from the Papa Sub Health Centre are 8 times higher than Porebada Sub Health Centre.**

## 6.10 Environmental Health Area 6—food- and nutrition-related issues including food security

This EHA considers the situation regarding community and household levels of nutrition and food security. From a health perspective, nutrition is strongly tied to a wide variety of outcomes, including anaemia, micronutrient deficiencies, and anthropometric outcomes such as height and weight for age in children and adults.

### 6.10.1 Overview

Many people and communities in Papua New Guinea still face the threat of under-nutrition. In Papua New Guinea, 80% of its population still lives a traditional lifestyle of subsistence farming, hunting, and fishing (Duke 1999; Gibson et al.1991; Temu et al. 2009). There are LNG Plant village household level diet and subsistence (gardening and fishing) data reported in the Baseline Social Report.

A standard method of non-invasively evaluating nutritional status is the use of anthropometry. According to WHO (1995), anthropometric measurements assess body size and composition and reflect inadequate of excess food intake, insufficient exercise, and disease. Anthropometry is considered the single most universally applicable, inexpensive, and non-invasive method available to assess the size, proportions, and composition of humans (WHO 1995).

Other indirect, but slightly more invasive measures of nutritional status include whether an individual is anaemic based on a finger-stick measurement of haemoglobin (Hb). Anaemia is a condition in

which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic needs. Iron deficiency is thought to be the most common cause of anaemia globally, but other nutritional deficiencies (including folate, vitamin B12, and vitamin A); acute and chronic inflammation; parasitic infections; and inherited or acquired disorders that affect Hb synthesis, red blood cell production, or red blood cell survival can all cause anaemia (WHO 2011b). Hb concentration alone cannot be used to diagnose iron deficiency. Nevertheless, WHO recommends Hb measurement even though not all anaemia is caused by iron deficiency (WHO 2011b). WHO has published standard levels to diagnose mild, moderate, and severe anaemia for children and adults (WHO 2011b).

Household level anthropometric and Hb were not performed as part of the baseline household social and health field exercise; however, key nutritional KPI data are reported by LNG Plant village health facilities, specifically the percentage of low birth weight (<2,500 grams) infants and the percentage of children with moderate to severe malnutrition. NDOH defines moderate/severe malnutrition as the percentage below two standard deviations of the WHO standard weight for age (NDOH 2021).

### **6.10.2 Sources of information**

This subsection discusses the sources of information used for EHA 6. PNG IMR published an extensive “Children’s Health Report” (PNG IMR 2016) that analysed basic nutrition performance and food security across three locations: Hiri, Hides, and Asaro. This study did not, however, include either formal anthropometric measurement or Hb determinations.

#### **National Department of Health data**

The 2021 eNHIS and SPAR data provide an overview of nutritional related indicators for Central Province, Kairuku-Hiri District, and Porebada and Papa sub health centres with comparison to National Capital District and national data. These data are shown in Table 6-43.

**Table 6-43. Nutritional key performance indicator data for Central Province, Kairuku-Hiri District, Porebada and Papa sub health centres**

| Indicator                                 | Central Province | Kairuku-Hiri District | Porebada Sub Health Centre | Papa Sub Health Centre | 2020 National Capital District | 2020 Papua New Guinea National |
|-------------------------------------------|------------------|-----------------------|----------------------------|------------------------|--------------------------------|--------------------------------|
| Low Birth Weight- % <2,500 grams          | 6%               | 4%                    | 9%                         | 6%                     | 9%                             | 7%                             |
| Malnutrition-moderate/severe (z score <2) | 13%              | 15%                   | 7%                         | 9%                     | 10%                            | 17%                            |

Source: 2021 eNHIS; NDOH 2021

#### **Project baseline reports**

The Tetra Tech Coffey Baseline Social Study provides information and data regarding subsistence practices and food security. There is variability across villages in terms of participants’ perceptions of food shortages, ranging from 4% in Boera, 11% in Lea Lea, 15% in Papa, and 23% in Porebada. The PNG IMR survey data (March 2016 Report) for the LNG Plant villages reported overall higher percentage values (41% within the last year); however, these survey data could have been impacted by the drought conditions that occurred across Papua New Guinea in 2015.

### Summary

- The available health facility data demonstrate that potential nutritionally related problems are present for some households, as shown by LNG Hiri Village Sub Health Centre data for low birth weight (9% for Porebada Sub Health Centre and 6% for Papa Sub Health Centre) and moderate/severe malnutrition (7% for Porebada Sub Health Centre and 9% for Papa Sub Health Centre).

## 6.11 Environmental Health Area 7—non-communicable diseases

This EHA considers the situation regarding NCDs, specifically cardiovascular disease, diabetes, obesity, and cancer.

### 6.11.1 Overview

NCDs are largely driven by a change from subsistence foods to a more Western-style diet. Changes in income, particularly conversion from subsistence to wage based, can drive increased purchases of trade store products, including highly processed foodstuffs, sugary drinks, alcohol, and tobacco products.

NCDs and associated risk factors, such as smoking, excessive alcohol consumption, obesity, hypertension, abnormal cholesterol and lipid profiles, and physical inactivity have not been well investigated in Papua New Guinea. Several relatively small studies conducted among specific populations have identified an increasing or relatively high prevalence of diabetes, cardiovascular disease, and cancers (Ogle 2001; Dowse et al. 1994; Misch 1988; Kende 2001; Uljaszek 1998; Henderson and Aiken 1979; Martin et al. 1980). Available evidence further suggests variation in NCD risk within Papua New Guinea based on ethnic origin (Natsuhara et al. 2000; Jamrozik 1985; Atkinson et al. 1982) as well as lifestyle and living environment (Benjamin 2007; Saweri 2001). For example, the Wanigela people of Port Moresby have some of the highest rates of diabetes recorded in the Pacific (Dowse et al. 1994), and urban dwellers of any ethnic origin in Papua New Guinea are more at risk of NCDs relative to their rural peers (Benjamin 2007; Kende 2001), although even rural populations appear to be increasingly prone to NCDs (Uljaszek 1998).

### 6.11.2 Sources of information

This subsection discusses the sources of information used for EHA 7.

#### National Department of Health data

Outcomes related to NCDs are not established SPAR KPIs. Papua New Guinea health facilities are generally not equipped to diagnose NCDs and staff training for NCDs is minimal. Laboratory support for NCD diagnosis is rarely, if at all, available at health facilities below hospital status/level. Hence, NCD diagnoses are not available at the sub health centre reporting level.

#### Private company-sponsored studies

As part of the PiHP, a 2017 PNG IMR study (PNG IMR 2017) established a baseline prevalence for selected NCDs, associated lifestyle risk factors, dietary habits, and food security at three integrated Health and Demographics Surveillance System (iHDSS) locations, Hiri, Karkar, and Asaro, with a total of 774 participants. In the LNG Plant villages results indicated:

- Underweight (7%), normal (46%), overweight (24%), and obese (22%);

- Anaemia (34%);
- Abnormal lipids (elevated cholesterol % + elevated triglycerides %) (68%); and
- Elevated glucose (pre-diabetes + diabetes) (34%).

A March 2017 PNG IMR study of men in the LNG Plant villages demonstrated significant levels of smoking. The overall prevalence rate of current tobacco users, including current smokers<sup>8</sup> and smokeless tobacco users<sup>9</sup> was very high, about 64% among all men aged 15–64, but highest in Hiri (82%) compared to 48% and 51% in Asaro and Hides, respectively.

In the same 2017 PNG IMR study, the prevalence of “heavy episodic drinking” (HED) was also assessed. HED is defined as having six or more standard alcoholic drinks per episode, equivalent to consumption of 60 grams of ethanol on a single occasion in the last 30 days.

The prevalence of HED was 57% among men (ages 15–64) in the LNG Plant villages. Nearly 50% of the current drinkers in Hiri had two to three HED episodes in the past 30 days. Furthermore, 80% of the current drinkers consumed alcohol without concurrent food ingestion, with the highest proportion recorded in Hiri men (90%) followed by Asaro men (70%) and Hides respondents (20%). Men with higher education and in the age group 34–44 years drank more frequently and with larger quantities versus men with lower educational status. Men were more likely to drink on Friday (three drinks per occasion) and especially Saturday (four drinks per occasion). The correlation of higher educational status with increased drinking implies that socio-economic status (income level) may be an important factor.

The reported findings indicate a likely undiagnosed, burden of NCDs in the general adult male population of the LNG Plant villages consistent with the mortality trends previously described in earlier sections of this baseline report. Given the extremely high levels of tobacco and alcohol usage, the momentum and size of the NCD disease “wave” is likely to increase over time.

For the LNG Plant villages, there is increasing evidence that a significant epidemiological transition is likely in progress—a change in adult morbidity and mortality patterns from infectious diseases to NCD.

Issues surrounding NCDs arose during community health discussions (hypertension, cervical cancer, and diabetes). NCDs were also a topic of concern during the KIIs with health personnel.

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<sup>8</sup> Including cigarettes, bidis, cigars, cheroots, pipes, shisha (water pipes), fine cut smoking articles (roll-your own), krekets, and other forms of smoked tobacco.

<sup>9</sup> Including moist snuff, creamy snuff, dissolvables, dry snuff, gul, loose leaf, red tooth powder, snus, chimo, gutkha, khaini, gudakhu, zarda, quiwam, dohra, tuibur, nasway, naas/ naswar, shammah, betel quid, toombak, pan, iq'milk, mishri, tapkeer, tombol, and other tobacco products that are sniffed, held in mouth, or chewed.

### Summary

- There is minimal morbidity data related to NCDs reported through the eNHIS.
- PNG IMR surveys indicate that there is a level of undiagnosed NCDs present across the LNG Plant villages.
- The level of smoking (82% men ages 15–64 and alcohol use [HED 57% men ages 15–64]) in the LNG Plant villages was brought up as a significant concern during the health discussions and Kills.

## 6.12 Environmental Health Area 8—accidents and injuries

This EHA considers the underlying burden of trauma-related morbidity in local communities. Road and marine traffic patterns are considered.

### 6.12.1 Overview

Injuries are a neglected epidemic in developing countries, causing more than 5 million deaths each year, roughly equal to the number of deaths from HIV/AIDS, malaria, and tuberculosis combined (Gosselin et al. 2009). The Global Burden of Disease and Risk Factors study forecasts that by 2020, 20% of ill-health in the world will be injury related (Gosselin et al. 2009).

More than 90% of injury deaths occur in low- and middle-income countries, where preventive efforts are often non-existent and health care systems are least prepared to meet the challenge. As such, injuries clearly contribute to the cycle of poverty and have an impact on individuals, communities, and societies. There are many dimensions to injuries: human (victim, caregiver) environment (infrastructure, legislation), and vector (motor and marine and river vehicles for injuries, weapons for violence, open fires for burns).

### 6.12.2 Sources of information

This subsection discusses the sources of information used for EHA 8.

#### National Department of Health data

The documented outpatient and inpatient burden of disease for accidents/injuries is significant. The outpatient accident and injury data (rate per 1,000) for the Central Province, Kairuku-Hiri District, and Porebada and Papa sub health centres are shown in Table 6-44. 2020 SPAR National Capital District and Papua New Guinea National data are shown for comparison. SPAR injury data are consolidated into one category and not further disaggregated by presenting type of injury, such as motor vehicle and falls. The eNHIS data do report motor vehicle injury presentations and these data for Papa and Porebada sub health centres for 2019–2021 are shown in Table 6-45.

**Table 6-44. Injury presentation per 1,000 population data (2021)**

| Indicator                                | Central Province | Kairuku-Hiri District | Porebada Sub Health Centre | Papa Sub Health Centre | 2020 National Capital District | 202 Papua New Guinea National |
|------------------------------------------|------------------|-----------------------|----------------------------|------------------------|--------------------------------|-------------------------------|
| Injury presentation per 1,000 population | 22               | 26                    | 5                          | 42                     | 24                             | 33                            |

Source: NDOH 2021

**Table 6-45. Papa and Porebada sub health centres motor vehicle injury data 2019–2021**

|      | Papa Sub Health Centre - Motor vehicle injury presentations (#) | Porebada Sub Health Centre - Motor vehicle injury presentations (#) |
|------|-----------------------------------------------------------------|---------------------------------------------------------------------|
| 2019 | 9                                                               | 5                                                                   |
| 2020 | 16                                                              | 6                                                                   |
| 2021 | 10                                                              | 5                                                                   |

Source: eNHIS 2019–2021

During the 2019 field exercise, there are no active and staffed Hiri District emergency response services available in any of the LNG Plant villages, although ambulances are present at the district headquarters offices in POM.

### Project baseline reports

Domestic violence and crime are described in the Baseline Social Report. Gender-based violence (GBV) data are considered in Section 6.14 Environmental health area 10—social determinants of health.

Snake bite was a topic of concern expressed during the FGD and KIs with health personnel.

#### Summary

- Overall injury data are available for the LNG Plant villages including motor vehicle injury data presentations for 2019–2021.

## 6.13 Environmental Health Area 9—exposure to potentially hazardous materials

This EHA considers whether there is substantial underlying hazardous material exposure to individuals and communities, such as pesticides, heavy metals, and petroleum hydrocarbons. Water and air pollution along with noise, vibration, and illumination are considered, although these are typically covered in environmental assessments and are addressed in technical studies for the EIS.

### 6.13.1 Overview

Hazardous materials issues are discussed in the EIS.

### 6.13.2 Sources of information

This subsection discusses the sources of information used for EHA 9.

#### National Department of Health data

There are no health facility data regarding hazardous materials exposure issues.

#### Private company-sponsored data

There are no published data regarding exposure to hazardous materials in studies relevant to the LNG Plant villages.

#### Project baseline reports

The main noise sources in the study area communities are natural, such as wind noise in foliage, insects, birds and domestic animals, in addition to typical village noises, such as children (SLR 2019b). Operational noise from the LNG Plant, such as emergency flaring, occurs sporadically.

Background noise levels were measured at each monitoring location listed in Table 5.20. The monitoring results at all sites indicate that evening and night-time background noise is higher than daytime. This was attributed to elevated insect noise during the evening and night periods which is typical across Papua New Guinea.

**Table 6-46. Background noise levels in study area**

| Location             | Background noise level, dBA <sup>(a)</sup> |                          |                       |
|----------------------|--------------------------------------------|--------------------------|-----------------------|
|                      | Day (7:00 to 18:00)                        | Evening (18:00 to 22:00) | Night (22:00 to 7:00) |
| Metago Bible College | 53                                         | 52                       | 46                    |
| Papa Village         | 49                                         | 52                       | 57                    |
| Boera Village        | 55                                         | 51                       | 49                    |
| Lea Lea Village      | 53                                         | 49                       | 44                    |

Source: SLR 2019b [R012].

<sup>(a)</sup> Noise levels presented as equivalent continuous sound levels over an hour. This measurement provides an average calculation of sound within one hour.

Emissions from the existing LNG Plant operations are the main source of air pollutants in the study area. Other sources of air emissions also include domestic and agricultural activities carried out in the study area villages (including fires), traffic-related emissions from local roads and natural sources, such as sea salt (SLR 2019a).

The existing air quality is generally good and complies with relevant criteria; however, short-term events of slightly elevated levels occur at times which may be caused by temporary, localised sources (SLR 2019a).

The existing LNG Plant occupies a substantial area, with its presence and operations visible to both Papa and Lea Lea villages. During the household surveys undertaken for the social baseline study (Tetra Tech Coffey, 2023), approximately 60% of respondents in those villages reported a high level of effect on environmental amenity primarily due to flaring effects. Common flaring effects reported by respondents included noise, light, odour and heat. A lower percentage of households in Porebada and Boera (approximately 40%) reported a high level of effect on environmental amenity.

## Community surveys

There were no hazardous materials exposure issues/concerns expressed during the health discussions and KIs.

### Summary

- An extensive baseline noise survey has been performed.
- No hazardous materials exposure issues/concerns were expressed during the health discussions and KIs.

## 6.14 Environmental Health Area 10—social determinants of health

This EHA considers the standard SDH plus psychosocial issues including alcohol, drugs, and GBV.

### 6.14.1 Overview

SDH are the conditions in which people are born, grow, live, work, and age, and include the state of the health system with which they interact (described in Section 6.2 EHA 1—health systems).

According to WHO, health follows a social gradient: better health with increasing socio-economic status, literacy, and educational attainment, particularly for women (2022). All of these elements are associated with a higher housing standard, healthier working conditions, and better access to health care and health education.

Substance abuse including alcohol, tobacco, or other drugs is not only an important health determinant but also closely linked to mental health. Misuse is associated with addiction, crime, transactional sex, and domestic violence.

### 6.14.2 Sources of information

This subsection discusses the sources of information used for EHA 10.

#### National Department of Health data

SPAR and eNHIS data do not directly address SDH, such as income and educational attainment, or psychosocial issues such as drugs/alcohol and GBV. The health facility morbidity does not directly capture SDH—tally sheet data cannot be sorted by village location, age, marital status, income, or education.

#### Private company-sponsored data

As part of the PiHP, PNG IMR performed large surveys that looked at outcomes associated with SDH, such as socioeconomics and educational attainment; however, these data are now 8–10 years old and may not reflect the current socio-economic situation in the LNG Plant villages. The most current socio-economic and educational attainment data are available in the LNG Plant Social Baseline.

#### Domestic and sexual violence

Domestic and sexual violence (DV) is considered within the SDH EHA rather than under the accidents/injuries EHA. PNG IMR performed extensive surveys in the LNG Plant villages regarding DV to obtain both a male and female perspective on this issue (PNG IMR 2016, 2017). In general,

both the 2019 male and female perspectives on DV are aligned and consistent with the 2016–2018 DHS study.

Understanding men's perceptions of DV provides an opportunity to better understand DV context and contrast it to a women's perspective. In the male PNG IMR studies, participants were asked to speak about what they believe causes DV to their female partners in a variety of situations, including if she goes out without telling him; if she neglects the children; if she argues with him or the elderly; if she refuses to have sex with him; or if she burns the food.

In the LNG Plant villages, more than 55% of the male respondents perceived it was justified to beat or hit their wives or sexual partners when she went out without informing her husband or sexual partner. Twenty-three percent of men perceived that it was justified for a man to hit or beat his wife/sexual partner if she refused to have sex with him. Similarly, 20% of men thought DV was justified if the female partner/spoused burned food or neglected the children (57%). Seventeen percent of men reported beating their female partners with something in the last 12 months. There was a marked inverse correlation between male educational attainment and positive DV response across all categories.

Alcohol consumption appears as a high risk factor associated with DV with 73% of men in the LNG Plant villages reporting an episode of alcohol fuelled DV. The prevalence of HED was 57% among men (ages 15–64) in the LNG Plant villages. HED is defined as having six or more standard alcoholic drinks per episode, equivalent to consumption of 60 grams of ethanol on a single occasion in the last 30 days. Women in Papua New Guinea have extremely low rates of alcohol usage. Nearly 50% of the current drinkers in Hiri had two to three HED episodes in the past 30 days. Overall, the male DV results are consistent with the data on domestic violence from the PNG IMR March 2016 Report, which focused on women's health issues.

### Project baseline reports

SDHs are complex and multi-factorial issues. The LNG Plant Social Baseline presents baseline data covering key social determinants: demography, educational attainment, literacy, crime/security information, GBV, and drug/alcohol use. The available, LNG Plant village specific database is quite robust due to the 2016 and 2017 PNG IMR survey work and is aligned with the LNG Plant Social Baseline findings.

Key SDH issues were addressed during the health discussions and KIIs, particularly with women. Issues like domestic violence, education, and income opportunities were described. Teen pregnancy was identified as an issue in all the health discussions.

#### Summary

- **The Tetra Tech Coffey Social Baseline Report presents baseline data covering key social determinants: demography, educational attainment, literacy, crime/security information, GBV, and drug/alcohol use.**
- **The available, LNG Plant village specific database is quite robust due to the 2016 and 2017 PNG IMR survey work and is aligned with the 2019 Social Baseline Report findings.**

## 6.15 Environmental Health Area 11—veterinary medicine and zoonotic diseases

This EHA considers the underlying burden of diseases transmitted from animals to humans.

### 6.15.1 Overview

Diseases that originate from animals but can be transmitted to humans are known as zoonotic illnesses. There are many reasons why zoonotic illnesses emerge and spread, including intensified livestock production, increased human travel and food-associated trade, and reduction of and encroachment on wildlife habitat (Bordier and Roger 2013). There is some understanding with respect to the ecological systems within which new or previously unknown pathogens can emerge (Keesing et al. 2010). The COVID-19 outbreak is another example of a zoonotic disease outbreak. The role of local markets and trade networks has also been demonstrated, particularly in the spread of avian influenza and COVID-19 (Fournie et al. 2013; WHO 2020). It is also important to recognize the continuous and widely underestimated challenge for human and animal health through the emergence of resistant pathogens resulting from evolutionary pressure exerted by antimicrobial usage (Orton et al. 2013). There is a small surveillance program in Papua New Guinea for zoonotic diseases as part of the National Agriculture and Quarantine Inspection Agency.

### 6.15.2 Sources of information

This subsection discusses the sources of information used for EHA 11.

#### Peer-reviewed published literature

There are no peer-reviewed publications regarding zoonotic diseases for the Central Province.

#### National Department of Health data

The health facilities in the LNG Plant villages do not have the laboratory capability to reliably diagnose a zoonotic illness. Some percentage of diarrhoea cases is undoubtedly zoonotic in origin. PNG IMR investigations regarding febrile illness demonstrated that animal husbandry (such as pigs and chickens) was a clear contributory factor to diarrhoeal febrile illnesses across the LNG Plant Village surveillance sites (PNG IMR 2015). There are no available SPAR or eNHIS zoonotic disease data.

#### Project baseline reports

The social baseline survey results indicate that hunting does not provide a major source of food for villages in the study area aside from Papa. Papa residents also mentioned the importance of hunting to their livelihoods during the focus group discussion held in the village and specified that they hunt deer, pig, and wallabies, both for household consumption and market sales. Income is generated through the sale of this bush meat, indicating potential exposure to animals during the meat preparation process.

Zoonotic disease issues were not highlighted by any respondents during health discussions or KIs.

#### Summary

- Zoonotic disease data are not specifically collected or reported by SPAR or eNHIS.

## 6.16 Environmental Health Area 12—cultural health practices

This EHA considers the role of traditional medical providers, medicines, and cultural beliefs that influence health behaviours and outcomes.

### 6.16.1 Overview

The analysis of cultural health practices applies a medical anthropology lens to a community's knowledge, attitude, and practices regarding health and illness. All cultures have systems of health beliefs to explain what causes illness, how it can be cured or treated, and who should be involved in the process. The extent to which patients perceive health education as having cultural relevance for them can have a profound effect on their reception to and willingness to use the information provided.

Cultural differences affect patients' attitudes about medical care and their ability to understand, manage, and cope with the course of an illness, the meaning of a diagnosis, and the consequences of medical treatment. In addition, culture specific values influence patient roles and expectations. In many cultures, including Papua New Guinea, sorcery is an important and powerful social phenomenon and a way of explaining the causation of disease (Franklin 2010).

As noted by Franklin (2010), in Tok Pisin, words used in the etic genre of sorcery are *poisen*, *poisen man*, *poisen meri*, *puripuri*, *pawa*, *blak pawa*, *kawawar*, *marila*, and *tambaran* (man). Franklin writes, "...it is important to note that in the folk beliefs there is no separation of what happens in the so-called spiritual realm on the one hand and the natural on the other" (Franklin 2010, 5). Franklin also notes:

Nevertheless, *poisen* is generally (and generically) used in Tok Pisin for sorcery and as a substance that is allegedly placed in food or other places to cause sickness and even death. There are *poisen* types, such as *maus poisen* (words that are performatives, spoken or called out to direct the power of the word towards an individual), and *poisen* men and women (*poisen meri*), who can kill people by supernatural means, sometimes removing or damaging their organs (Franklin 2010, 5).

According to Franklin, "sorcery, especially the violent *sanguma*, is prevalent in PNG and shows no signs of diminishing" (2010, 9). *Sanguma* has been glossed in English as both "witchcraft" and "assault sorcery" (Franklin 2010).

### 6.16.2 Sources of information

This subsection discusses the sources of information used for EHA 12.

#### Peer-reviewed published literature

There are no peer-reviewed publications regarding cultural health practices in the Central Province.

#### Project Baseline Reports

During the FGD and KIIs, very few respondents reported using traditional health providers. Sorcery concerns were raised in both male and female FGD and KIIs. In addition, traditional perspectives on illness causation are extremely strong—illness is often attributed to individual "bad acts" rather than to a biomedical mechanism.

**Summary**

- The role of traditional health practitioners does not appear to be substantial across the LNG Plant villages.

## 7. Conclusions

Based on the EHA framework, this Baseline Community Health Report is a systematic presentation of the following available health information for the LNG Plant villages:

- Peer-reviewed scientific journal publications
- 2016–2018 DHS
- eNHIS data at the national, provincial, district and local health facility level
- Relevant PNG IMR studies collected as part of the PNG LNG Project-sponsored PiHP (2013–2017)
- Relevant PNG IMR studies collected as part of the CHERES program 2016–2018
- International agency data including WHO and the World Bank Group
- Multilateral funding agency data including Global Fund, USAID, and DFAT
- NGO data including materials from MSF and RAM
- Data collected by the ExxonMobil LNG Medicine and Occupational Health Department.

The following key findings are identified in this report:

- The population demographics for the LNG Plant villages are well characterised and based on strong contemporary survey data.
- The general morbidity and mortality burden of disease across the LNG Plant villages is characterised and documented.
- FGD and KIIs concerns and observations are aligned with the available objective data.
- The Papa Sub Health Centre is the critical health facility for the LNG Plant villages based on outcome, output, and process measures. The Porebada Sub Health Centre facility has lower overall outcome, output, and process measures in comparison to the Papa Sub Health Centre. .
- Communicable respiratory diseases, including COVID-19, are a high percentage cause of the observed burden of disease across the LNG Plant villages. Tuberculosis was consistently expressed as a significant health concern during FGD and KIIs.
- PNG IMR 2019-2002 surveys and eNHIS data indicate that malaria is at low levels (<2% prevalence) across the LNG Plant villages. Based on DHS data and PNG IMR and RAM surveys, bed net distribution efforts have been successful (88% for combined LNG Plant villages). The actual level of proven malaria is mismatched with the community and household perceptions of malaria, specifically, household members believe that malaria is common and is a significant source of fever.
- Based on ANC surveillance (females), the current national level of HIV disease is stable (1%) and consistent with past PNG IMR surveys from 2013/14. The 2019–2021 ANC HIV surveillance data (females) for the Papa (3%) and Porebada (1.8%) sub health centres are higher than the overall national data. The burden of non-HIV STIs is uncertain as diagnoses are made clinically without laboratory confirmation.
- As reported by the Papa Sub Health Centre (eNHIS 2021 data), the burden of diarrhoeal disease incidence in children <5 years of age per 1,000 children is higher than the overall Central Province and Kairuku-Hiri District.

## **Papua LNG Project – Downstream | Community Health Baseline**

- Malnutrition levels reported by both Papa and Porebada sub health centres (eNHIS 2021 data) are lower than percentages reported by the Central Province and Kairuku-Hiri District.
- The rate of injury presentation per 1,000 population reported by the Papa Sub Health Centre is higher than rates reported by the Central Province, Kairuku-Hiri District, and Porebada Sub Health Centre.
- Alcohol and tobacco usage levels in the LNG Plant villages are noted to be an important concern in FGD and KIIs.
- There are no laboratory facilities at either Papa or Porebada Sub Health Centres for diagnosing zoonotic diseases. Zoonotic disease data are not reported in SPAR or within the eNHIS system.
- The use of traditional medical providers was not documented; however, there were great concerns regarding sorcery expressed during the FGD and KIIs.

Sufficient information has been collected and presented in this report to meet the specific objectives outlined in Section 1.2.

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## Papua LNG Project – Downstream | Community Health Baseline

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